THE
YEAR-BOOK
OF
FACTS.
1854.

F. Arago

THE

YEAR-BOOK OF FACTS

IN

Science and Art:

EXHIBITING

THE MOST IMPORTANT DISCOVERIES & IMPROVEMENTS
OF THE PAST YEAR;

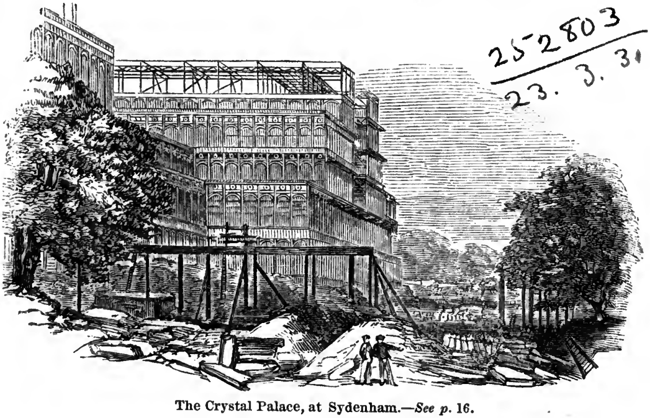
IN MECHANICS AND THE USEFUL ARTS; NATURAL PHILOSOPHY; ELECTRICITY; CHEMISTRY; ZOOLOGY AND BOTANY; GEOLOGY AND GEOGRAPHY; METEOROLOGY AND ASTRONOMY.

By JOHN TIMBS,

EDITOR OF "THE ARCANA OF SCIENCE AND ART."

"The wider the spread of Science, the wider will be the sphere of its usefulness. One great duty which we owe to the public is, to encourage the application of abstract science to the practical purposes of life—to bring, as it were, the study and the laboratory into juxtaposition with the workshop."

Mr. Hopkins, *President of the* British Association, 1853.



The Crystal Palace, at Sydenham.—*See p.* 16.

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ARAGO.

(*With a Portrait, from a Photograph by* CLAUDET.)

IN the past year, France has lost one of her greatest lights, and Science has been shorn of one of her brightest beams: Arago is numbered with the illustrious dead. A glorious luminary has left our lower sphere; but his immortal writings will shed a lustre upon the paths of Science as long as the world is governed by the same laws.

Dominique-François-Jean Arago was born in the village of Estagel, near Perpignan, in the Pyrenees, on the 26th of February, 1786; and he died at the Observatory, in Paris, on Sunday, the 2nd of October—consequently he was in the 68th year of his age. His father, who was cashier at the mint of Perpignan, encouraged the early taste of his son for science; but though he is said not to have been able to read at the age of fourteen, he made such rapid progress at the College of Montpellier that he was admitted at the age of eighteen a pupil of the Polytechnic School at Paris. In this able Seminary, where the most distinguished of the French philosophers received their education, young Arago took the lead of his fellow-scholars; and obtained such eminence in mathematics and astronomy, that he was appointed, in 1806, Secretary to the Board of Longitude. In this office he remained two years, when he was appointed, along with Biot and two Spanish commissioners, MM. Chaix and Rodriguez, to complete the measurement of the arc of the meridian, from Dunkirk to Barcelona, which had been begun by Mechain and Delambre, as the basis of the Metrical Decimal System first adopted by the Convention. This scientific labour was considerably advanced, when Biot returned to Paris, leaving Arago in charge of the important work. The war commencing at this time between France and Spain put an end to this mission of science; and the young mathematician had to make his escape in disguise from an enraged and ignorant peasantry. He escaped only to become a prisoner; and when eventually liberated by the Spaniards, he fell into the hands of an Algerine corsair, and was released from captivity by the Dey of Algiers only in 1809.

At the age of twenty-three, Arago returned to Paris; and, as a reward for his zeal, upon the death of the celebrated astronomer Lalande, Arago, though only twenty-three years of age, was, in opposition to the standing rules of the Academy of Sciences, appointed to the vacant place in the section of astronomy. Although Arago, when a pupil at the Polytechnic School, had voted against the assumption of the consulate for life, yet Bonaparte, who knew how to value an honourable man, never resented this act of hostility; but, remembering the courage of the young philosopher, he appointed him one of the Professors of the Polytechnic School, and subsequently Director of the Imperial Observatory, in which he resided till his death.

During this period, M. Arago contributed sixty distinct memoirs on various branches of science; the most important of which appeared in the *Annuaire du Bureau des Longitudes*, the *Comptes Rendus Hebdomadaires des Scéances de l'Academie des Sciences*, and the *Annales de Physique et de Chimie*.

Arago's first contribution to science was made in conjunction with the illustrious M. Biot. The paper was entitled, "On the Affinities of bodies for Light, and particularly on the Refractive Powers of the different Gases," and was read at the Institute on March 24, 1806, when Arago was only twenty years of age.

In the year 1808, the Institute of France proposed *The Double Refraction of Light*, as the subject of a prize to be awarded in 1810. The prize was adjudged to E. L. Malus (a member of the Egyptian Institute, and Colonel of the Imperial Corps of Engineers), who was thus led to the great discovery of the *Polarization of Light by Reflection* from the surfaces of transparent bodies, a subject which was diligently studied in France by Arago, Biot, and Fresnel; and in England by Dr. Young and Sir David Brewster. M. Arago, the friend of Malus, was the first to publish the result of his researches. On August 11, 1811, he communicated to the Institute a memoir, "On a particular modification which the Luminous Rays experience in their passage through certain Transparent Bodies;" and this memoir was followed by a series of discoveries made on both sides of the Channel, which Sir John Herschel has characterized as "presenting a picture of emulous and successful research, than which nothing prouder has adorned the annals of physical science since the development of the true system of the universe."

Omitting from the list of Arago's contributions to science those astronomical notices which regularly appeared in the *Annuaire,* we find his memoirs "On the Comets of Short Period;" "On the Pendulums of MM. Breguet;" "On Chronometers;" "On the Double Stars;" and on the vexed question, "Does the Moon exercise any appreciable influence on our atmosphere?" Passing from astronomical subjects, we find several memoirs:—"On Nocturnal Radiation;" "The Theory of the Formation of Dew;" and on allied subjects,—as "The Utility of the Mats with which Gardeners cover their Plants by Night;" "On the Artificial Formation of Ice," and "On Fogs which form after the Setting of the Sun, when the Evening is calm and serene, on the Borders of Lakes and Rivers." Indeed, the whole of the phenomena to which Dr. Wells had directed attention in his excellent work "On Dew," were thoroughly investigated by M. Arago. When we add his memoirs on "The Ancient Relation of the Different Chains of Mountains in Europe;" "The absolute Height of the most remarkable Ridges of the Cordilleras of the Andes;" "Historical Notices of the Steam Engine;" "On Explosions of Steam Boilers;" "Historical Notices of the Voltaic Pile,"—those which are connected with the Polarization of Light, the Phenomena of Magnetic Rotation,—and on the Egyptian Hieroglyphics, we think we indicate labours of a most varied and important character.

Arago's discovery of the magnetic properties of substances not containing iron, was announced to the Academy of Sciences of Paris on November 22, 1824. By causing a magnetic needle to oscillate above or near any body whatever, such as a metallic plate, or a surface of water, the oscillations became less and less in amplitude, as if the needle had been placed in a resisting medium; and, what was very remarkable, the number of oscillations performed in a given time was not changed. The Royal Society of London adjudged the Copley medal, in 1825, to M. Arago for this discovery. In pursuing this subject, he discovered the production of Magnetism by Rotation; and his experiments excited so much interest in this country, that M. Gay Lussac repeated them in London in 1825.

It should, however, be stated here, that on several occasions M. Arago endeavoured to claim for his countrymen discoveries which had been previously made in England and elsewhere. Thus, M. Arago, in his "Historical Eloge of James Watt," with his usual force of language, prefaced his *éloge* by the following words:—

"I approach this inquiry with the firm determination of being impartial—with the most earnest solicitude to bestow on every improver the credit which is his due—and with the fullest conviction that I am a stranger to every consideration unworthy of the commission that you have conferred on me, or beneath the dignity of science originating in national prejudices. I declare, on the other hand, that I esteem very lightly the innumerable decisions which have already emanated from such prejudiced sources; and that I care, if possible, still less for the bitter criticisms which undoubtedly await me, for the past is but the mirror of the future."

After this, we find a constant effort to increase the value of each invention of Papin, and to lower the several improvements of Savery, Newcomen, and Watt. M. Arago could not deny the high claims of Watt; yet his national prejudices led him to place Papin and Watt on the same pedestal. Of a like character was the part which Arago took in the discussion respecting the rival claims of Adams and Leverrier.

In 1830, Arago was made Director of the Observatory,—and he succeeded Fourier as a perpetual secretary of the Academy of Sciences.

We have, of course, little to say on the political life of M. Arago. He was a consistent, philosophical republican; and we find in his "Lettre à MM. les Electeurs de l'Arrondissement de Perpignan," in 1831, his "Lettre sur les Forts détachés," and his "Lettre sur l'Embastillement de Paris," in 1833, evidences of a bold and liberal mind ever alive to the social interests of his fellow-men. As a deputy, M. Arago delivered a great number of speeches to the Chamber.

A mind so active as that of M. Arago could not be idle during the political convulsions of France. In 1840 he was elected a member of the Council-General of the Seine. He was named a member of the Provisional Government—and Minister of War and Marine *ad interim.* He laboured with all honesty to subdue the political storm. He displayed his courage in the sad days of July in the streets of Paris—endeavouring, but in vain, to stay the hand of the slayer:—but the result put an end to the political career of the philosopher. Another strong evidence of

moral and political courage was given by M. Arago in his refusal when summoned as a public officer to take the oaths to the government of Louis Napoleon. Rather than sacrifice his principles he resolved to quit the Observatory, and, in his old age, cast himself upon the world. This resistance was made the more remarkable by its result. Before his attitude the spirit of menace retreated. Government made an exception in his favour :—and at his death he still held the public offices which he filled so well and which he so highly illustrated.

In his capacity as perpetual Secretary to the Institute, it became the duty of Arago to write the Eloges of its members, both foreign and domestic, and among the vigorous and eloquent biographical sketches which came from Arago's pen, were these Eloges, with the dates at which they were read :—

1831—Volta, Foreign Associate.
1832—Dr. Thomas Young, Foreign Associate.
1833—Baron Fourier.
1834—James Watt, Foreign Associate.
1837—Carnot.
1841—Condorcet.
1844—Bailly.

Owing to the political condition of France, the memoir of Bailly, extending to nearly 200 pages, one of deep interest, was not published till the past year, when it appeared without any change. In an apology for errors of the press, the author makes the following touching remark:—"The public, which has always honoured me with its kindness, will have the goodness to remark, that having become almost completely blind, I could not superintend directly the revision of the proofs."

Although the disease with which he was affected was rapidly undermining his strength, and his physicians considered his case as about to have a fatal termination, yet he was able on Saturday, the 1st of October, to see Lord Brougham, and to take a large share in the conversation—and that too with a firmness of voice which indicated a greater degree of strength than he possessed. Lord Brougham left his distinguished friend much excited by the interview, and himself deeply depressed. Arago did not survive many hours. He died on the following day, Sunday, the 2nd of October.

During all his malady, his lofty intelligence was not obscured for an instant. Scarcely three weeks previously, he was labouring at a new edition of his celebrated work on Thunder; he recalled what he had read, dictated precious additions, caused difficult researches to be made, &c.; and he asked M. Babinet to prepare for him a table of the best determined numbers of the length of undulations, in order that he might complete an important paper on Light; he corrected the proofs of his Biographical Notice of Monge; he terminated his Notice on Planets, &c.; he discussed with perfect lucidity; he made profound remarks, &c.

In his personal appearance, Arago was tall and handsome, his expression highly intellectual, his manners pleasing, and his powers of conversation of a very high order.

Although Arago had refused to give his allegiance to the new Government, the Emperor, with much good taste, decreed a public funeral to his memory, which took place on the 5th of October, with much pomp.

For the accompanying Portrait we are indebted to M. Claudet; it is believed to be from the last sitting given by M. Arago to a photographer.

The previous Notice has been, in the main, selected and abridged from able Memoirs in the *Athenæum*, and the *Commonwealth*.

CONTENTS.

THE

YEAR-BOOK OF FACTS.

Mechanical and Useful Arts.

GENERAL IMPROVEMENTS IN MECHANICAL SCIENCE.*

MR. W. FAIRBAIRN has read to the British Association, an "Introductory Address on General Improvements in Mechanical Science during the past year." The first subject noticed by Mr. Fairbairn was Ericsson's Caloric Engine, from which so much had been expected. It was constructed, he said, on the same principle as the air engine of Dr. Stirling, invented ten years ago. The chief difference being, that the air in Ericsson's engine is passed through wire gauze to take up the heat, instead of through plates of iron. The great objection to the engine appeared to be that two-thirds of the power were wasted in passing the air through the gauze; and though it might be premature to pronounce an opinion before the results of the improvements lately effected were known, yet if so much of the power was required for taking up the heat, Mr. Fairbairn could not but think it must prove a wasteful expenditure of fuel.

The improvements that during the last year had been made in the application of the Screw Propeller were opening a new era in the history of our war and mercantile navy, of which the recent review at Spithead might be considered an indication. We were now in a state of transition between the paddle and the screw, and Mr. Fairbairn had no doubt that in the progress of time great improvements would be made in the construction of the engines, and in their applicability to the work, which would materially economize space and power in our steam vessels.

Mr. Fairbairn next alluded to the construction of an immense steam vessel, which had been undertaken by Mr. Brunel and Mr. Scott Russell, of such vast dimensions that it would stretch over two of the largest waves of the Atlantic, and would thus obtain a steadiness of motion which would be a preventive against sea-sickness. This mammoth steamer is to be 680 feet long, with a breadth of beam of 83 feet, and a depth of 58 feet. The combined power of the engines would be that of 2600 horses. The ship is to be built of iron, with a double bottom of cellular construction, reaching six feet above the water-line, and with a double deck, the upper and the lower parts being connected together on the principle of the Britannia tubular bridge, so that the ship will be a complete beam. It would thus possess the strength of that form of construction, and not be liable to "hogg," or break its back, as had been the case with other ships of great length. The double bottom would be a means of increased safety in other ways, for, if by any accident the outer shell were

* The British Association met at Hull, Sept. 7—14, 1853.

broken, the inner one would prove effectual to keep out the water. As an additional security, however, it was divided into ten water-tight compartments. The ship would be propelled by paddles and by a screw, which would be worked by separate sets of engines, so that if any accident occurred to the machinery of one, the other would be in reserve. Mr. Fairbairn said he had no doubt that if properly constructed this ship would answer the expectations entertained of the capabilities and strength, and that it would form, when completed, the most extensive work of naval architecture that had ever been constructed.

The next subject to which Mr. Fairbairn adverted was the improvements making in the Locomotive Department of Railways, particularly to an engine constructed for the southern division of the North-Western Railway, from the designs of Mr. M'Connell, which was the most powerful locomotive that had yet been made for the narrow gauge. The peculiarity of construction consisted in the great length given to the fire-box, in which the greatest amount of steam is always generated, and in the comparative shortness of the tubes, which were only half the usual length. The steam generated by this boiler was sufficient for any engine of 700 horse power. The engine was intended for an express train that would complete the distance from London to Birmingham in two hours.

In manufacturing machinery there had also been great activity and progress during the past year; and it was gratifying, Mr. Fairbairn observed, to find accompanying this improvement in machinery a most prosperous condition in the working-classes engaged in those manufactures—a prosperity which had never been equalled within his experience. He attributed this prosperous state of things to the combined operations of improvements in machinery and the removal of commercial restrictions. The improvement which he more especially noticed was that of a new Combing Machine of French invention applicable alike to cotton, to flax, and to wool. It combs the fibre instead of carding it, a number of small combs being applied in succession to the cotton or flax, by which means a much finer yarn can be produced from the same material than is possible by the former processes. As evidence of the present activity and enterprise in manufacturing industry, Mr. Fairbairn mentioned the erection of a mammoth alpaca woollen manufactory, by Mr. Salt, of Saltaire, near Bradford, which was 550 feet long, 50 feet wide, and six stories high, besides offices, warehouses, and various other buildings connected with it. The steam engines to drive the machinery would be equal to 1200 horse power, and the factory would employ upwards of 3000 hands. The cost of the whole would be upwards of £300,000, and the enterprise was that of a single individual. Mr. Fairbairn concluded his *résumé* of manufacturing progress by noticing the improvements introduced by Prof. Crace Calvert of Manchester, in the process of Smelting Iron by previously removing the sulphureous vapour from coal and coke. The results had proved most satisfactory, the strength of the iron produced by this process being about 40 per cent. greater than that made in the ordinary way.

THE NEW YORK INDUSTRIAL EXHIBITION.

THIS great national display was opened on July 14, 1853, with a ceremony much resembling that of the Exhibition in Hyde Park. We quote the *Athenæum* report:—On a platform were assembled the officials of the Palace, the officials of the State, and the celebrities of the Republic. The building was opened with prayer—and then a choral, composed for the occasion, was sung to the tune of the "Old Hundredth."

Here, where all climes their offerings send,
  Here, where all arts their tributes lay,
Before thy presence, Lord, we bend,
  And for thy smile and blessing pray.

For thou dost sway the tides of thought,
  And hold the issues in thy hand,
Of all that human toil has wrought,
  And all that human skill has plann'd.

Thou lead'st the restless Power of Mind
  O'er destiny's untrodden field,
And guid'st him, wandering bold but blind,
  To mighty ends not yet revealed.

—Mr. Theodore Sedgwick, the president of the association, addressed the President of the United States, in a speech, excellent in spirit, on the objects and prospects of the Exhibition:—and the President of the United States replied in a speech cut short by illness. Then, the organ poured through the aisles the music of Handel's "Hallelujah Chorus:"—and the palace of glass, with its fairy forms and mighty morals—England's original architecture, adopted by England's cousins and allies in the great cause (it may yet be battle) of civilization—was a completed American fact!

The American Exhibition differs from our own London one in this, that it is a private speculation: not, however, in the sense of the Dublin one. It exists under a charter granted by the legislature to a company calling themselves the "Association for the Exhibition of the Industry of all Nations." But the stock is distributed into so many hands,—the commercial interest is so widely extended,—that it gains much of the character of a national undertaking. The public support given by the government to its operations, at home and abroad, helped also to dignify it, and to take away the invidious character of an enterprise which had no higher aim than private gain: and following up this system of encouragement—amounting almost to State adoption—the Crystal Palace was opened—as was ours—by the head of the State in person.

The leading features of the exterior of the building were described in the *Year Book of Facts*, 1853; so that here we shall only glance at the interior.

"The Dome is supported by twenty-four columns, which rise beyond the second story, and to a height of sixty-two feet above the principal floor. The glass is one-eighth of an inch thick. The enamel, with which the whole of it is covered, is laid upon the glass with a brush, and, after drying, is subjected to the intense heat of a kiln, by

which the coating is vitrified, and rendered as durable as the glass itself. It produces an effect similar to that of ground glass, being translucent but not transparent. The sun's rays, diffused by passing through it, yield an agreeable light, and are deprived of that intensity of heat and glare which belongs to them in this climate.

"The rapid and unexpected increase of the applications of exhibitors induced the Association to erect a large addition to the building already described. It consists of two parts, of one and two stories respectively. Its length is 451 feet and 5 inches, and its extreme width is 75 feet. It is designed for the reception of machinery in motion, the cabinets of mining and mineralogy, and the refreshment rooms with their necessary offices. The second story, which is nearly 450 feet long, 21 feet wide, and extends the whole length, is entirely devoted to the exhibition of pictures and statuary. It is lighted from a skylight 419 feet long and 8 feet 6 inches wide."

The exterior presents the appearance of a building constructed of a light-coloured bronze, of which all features purely ornamental are of gold. The interior has a prevailing tone of buff, or rich cream colour, which is given to all the cast iron constructive work. The colour is relieved by a moderate use of the three positive colours, red, blue, and yellow, in their several tints of vermillion, garnet, sky-blue, and orange (certain parts of the ornamental work being gilt),—to accord with the arrangement of colours employed in the decoration of the ceilings. The only exceptions to the use of oil colours are in the ceiling of the American lean-to and in the dome: these decorations are executed in tempera on canvas.

In the classification of the contents of this edifice, the four grand departments adopted by the London Commissioners, together with the plan of classification, have been, with some slight modification, adopted.

The total amount of space on the floor occupied by different countries for exhibition, exclusive of the naves, is about 152,000 square feet; of which 94,102 is on the ground-floor, and 59,000 is in the gallery. This space is divided as follows:—

	Ground Floor.	Gallery.
England	10,570	7,081
Switzerland	1,458	2,970
Zollverein	6,196	6,053
Holland and Belgium	2,916	729
Austria	1,458	729
Denmark, Sweden, and Norway	2,916	1,315
Russia, &c.	729	
British Guiana and West Indies	1,093	
British Colonies	2,369	3,429

—The total amount of space occupied by foreign countries is 98,749 square feet.—[It will be seen that the above particulars do not nearly make up this amount; which is accounted for by the list of particulars being imperfect. The space claimed by the contributions of France and Italy, for instance, is not mentioned.]

The United States contributions occupy 34,585 square feet on the ground-floor, and 19,945 square feet in the gallery.

The total number of exhibitors from abroad are 2605, of which

England sends	677	Italy	185
France	521	Sweden and Norway	18
Switzerland	116	West Indies	3
Zollverein	813	Prince Edward's Island	15
Holland and Belgium	155	Nova Scotia	2
Austria	100		

This list has been increased, from the fact that the local committees of Canada had not sent in their list of contributors, and it does not include a number from British Guiana. A small number of Turkish and other contributors were also to be added, making the sum total of foreign exhibitors not far from 2700.

The total number of exhibitors, both foreign and American, is 4383. This is about *one-fourth* the number contributing to the London Exhibition.

THE DUBLIN GREAT INDUSTRIAL EXHIBITION

WAS opened May 14th, 1853, by the Lord Lieutenant, with nearly the same ceremony as the Crystal Palace in Hyde Park. The Building, described in the *Year Book of Facts*, 1853, was designed by Mr. (now Sir John) Benson, and is considered the most successful design for a structure of this kind. We abridge from the *Athenæum*, No. 1333, these details of the interior.

At one end of the central hall—425 ft. long, 106 ft. high, and 100 ft. wide—was placed an organ of great power, built by Messrs. Telford for St. Peter's College, Oxford, and lent to the Exhibition Committee. This instrument has three complete manuals, from CC to G in alt.; the pedal organ is from CCC to G—two and a half octaves, six composition pedals, four copulæ, and forty-five stops. It contains 3000 pipes. One of these, the CCCC, is 32 ft. long. The organ, when played, was heard well in any part of the central hall, the circular roof and ends of which are well adapted for sound. The selection for the opening ceremony included the National Anthem, the Hundredth Psalm, Handel's Coronation Anthem, Mozart's motett, "Oh God, when Thou appearest," the Hallelujah Choruses of Handel and Beethoven, the March from Athalie, the Hymn of Praise by Mendelssohn, and "The Heavens are telling." The orchestra consisted of 1000 performers.

In the Foreign Department, the Zollverein had a fair show of things:—fine castings and terra-cotta wares being predominant. The Vieille Montagne Company was also early in the field, and afforded an attractive point. Near the orchestra was the Chinese Department,—which made a glittering and imposing appearance, and included a large collection of rare and beautiful dresses brought from China by an officer in the British army.

The contributions of the East India Company maintained the honours which they won in Hyde Park.—Adjoining to these two latter collections was another which was perfectly unique and most remarkable. It consisted of specimens of Japanese ingenuity, contributed by the Dutch Government to the Exhibition, and was under

the care of M. Van de Kasteele, the Director of the Museum of Curiosities at the Hague,—to which the collection belongs. The beauty of many of the specimens is certainly unsurpassed. The small specimens of china exhibit a much higher condition of Art than that of the Chinese,—and the colours are brilliant and well chosen. The papier mâché is ornamented in the most elaborate, but at the same time in perfectly chaste, manner, in gold and mother-o'-pearl, inlaid with the greatest nicety, and brought to a perfect and brilliant surface. But the perfection of workmanship is exhibited in nearly all the portion of the collection which includes altar-pieces and screens, arms, ornaments, and clothing, musical instruments of many varieties, and beautifully constructed, mechanically, not scientifically, models of temples, ships, palanquins, and a hundred other articles. There was also a large number of drawings, maps, printing apparatus, and other things, which have scarcely ever been seen in England, in consequence of the very strict laws prohibiting their being taken out of the country. The offence of exporting a map of the country is punishable by the laws of Japan with death.

We can only glance at the miscellaneous contents of the Exhibition. Ireland's damasks and poplins occupied a very prominent place, and Messrs. Fry erected an elaborate Jacquard loom for weaving, in the Exhibition, a newly-invented brocaded poplin. The Royal Dublin Society had a fine collection of Irish marbles,—being part of a collection making for their new Museum. Manchester, Leeds, Rochdale, Bradford, Halifax, Leicester, Glasgow, and other places, exhibited many admirable specimens of their handywork. Coalbrookdale supplied a large assortment of its elegant iron wares. In the machinery department, the power was admirably distributed throughout the whole length of the hall, by means of a shaft supported by a line of cast-iron pillars which run down the centre, the various machines being worked by bands running over drums placed at intervals on the shaft. In this department were also printing-machines and presses of all descriptions, one of which was employed, during the Exhibition, in printing a shilling Guide to Dublin, for the use of visitors. The galleries made an excellent display of varieties. Prominent amongst these were Irish lace, embroidery, and needlework, including the cases and stands of the Ladies' Industrial Society of Ireland, and of the Seamstresses' Society of Dublin. The exhibitors of china and other wares, who were prominent at the Great Exhibition in Hyde-park, had displays of similar productions. The Irish Bible Society, the bookbinders, and many other crafts, made a good display.

The pictures formed one of the finest collections of modern paintings ever brought together. They filled one of the side halls, upwards of 300 feet long, and are divided into French, Belgian, Dutch, Prussian, British, and old masters. The French collection was neither large nor important. The Belgian included some admirable specimens by Wappers, Madou, Haesaert, Verböckhoven, Gallait, and others. The Dutch and German collections were fine. The English collection was especially remarkable for a large number of portraits and pictures illustrating Irish history; but it was also rich

in many other respects. Down the centre of the hall were placed specimens of sculpture. Many objects were familiar to the visitors of the Great Exhibition in Hyde-park, but the greater part of the specimens were by British sculptors.

The Exhibition was honoured with a visit from her Majesty and the Prince Consort on August 30; and was finally closed, on October 31, with a grand musical performance, in the presence of the Lord Lieutenant, Mr. Dargan, and others; and the indefatigable Secretary, Mr. Cusac Patrick Roney, was knighted on the occasion.

THE "ERICSSON" CALORIC SHIP.

Of this Vessel we gave a detailed account in the *Year Book of Facts*, 1853. The principle and application of the Caloric Engine have been amply illustrated, by Mr. Crispe, in a paper read at the United Service Institution on March 18th; and at the Institution of Civil Engineers, in three papers read on May 17th: 1, By Mr. C. Manby, F.R.S. (Secretary); 2, By Mr. J. Leslie, C.E.; 3, By Mr. W. C. Siemons.

From the *Scientific American* of November 19th, it appears that new engines have been built for the *Ericsson* by Messrs. Hogg and Delameter, of New York.

"They are in principle identical with that of Stirling—Ericsson having entirely discarded his 'regenerator,' and returned to the original plan of using the same *air* over again, but making no attempts to re-employ his *heat*. It seems, from this, that experiment has convinced him that his views concerning this feature of his engine were, as we have so often asserted, wholly at variance with science and philosophy; and as he claimed that in this regenerator was stored the great advantage of his over the steam-engine, we are unable to see on what grounds he will claim any superiority for this one.

"Immediately above the fire are placed six layers of cast-iron pipes, 9 feet in length, and 3½ inches in diameter; above these pipes are two heaters, 9 feet in length, and 2 feet 5 inches in diameter. These heaters are filled with tubes 2 inches in diameter, through which pass the flame and smoke from the fires. The cylinder is 5 feet 2 inches bore, and about 7 feet stroke. He also employs a *cooler*, 10 feet in length, and 3 feet in diameter, filled with tubes 1½ inches in diameter; among these tubes circulates a supply of *cold water*, for the purpose of condensing the air after it has passed from the cylinder. These various parts communicate with each other, but not with the external air, —the cold air from the cooler passing in the heaters, then through the cast-iron pipes immediately over the fire, then into the cylinder, and back to the cooler again. Hence, all the heat imparted by the fire to the air is given off to the water in the cooler, and is as fully lost as in the steam or any other engine.

"The question is now narrowed down to the relative economy of using the expansive force of air or of water as a motive power. The heating surface of this is also far greater than that of his last engine; but we cannot see any ground for supposing the performance of these engines to be very much superior to that of his former ones."

"THE GREAT REPUBLIC" CLIPPER SHIP.

DURING the past year, there was built at New York, by Donald M'Kay, a ship with the above national designation, to which was added, "the largest clipper in the world." We regret to add that this vast ship, ("*instar montis*," we might almost have said,) was totally destroyed by fire, as she lay in dock at New York, Dec. 26, 1853.

The Great Republic was 325 feet long, has 53 feet extreme breadth of beam, 39 feet depth of hold, including 7 feet between the spar and upper deck, and 8 feet between the two decks below, and registers 4555 69-95ths tons. She had four complete decks, but no bulwarks, for the outline of the spar-deck was protected by a rail upon turned oak stanchions. Her lines were slightly concave forward and aft, and her ends were very long and very sharp, particularly the bow, which preserved its angular form to the rail. The whole fore body of the vessel was raised about two feet from a straight line at the forefoot; but the rise was gradual for 60 feet, and formed an arch where the stem and keel were united. For a head she had the representation of an eagle, as if emerging from below the bowsprit; and her stern, which was semi-elliptical in form, was spanned by an eagle, with the American shield in his talons. The ship had a waist of nine narrow strakes, defined between mouldings, was sheathed with yellow metal up to 25 feet, and was painted black above it.

She had five houses on the spar deck amidships. The houses on the quarter-deck consisting of a mess-room for the officers, protected the entrances to the deck below, and contained signal lockers, &c. Such was her vast size, that all these houses appeared to occupy very little space. Indeed, she had more room on her spar-deck for working ship, than a line-of-battle ship.

Her crew had spacious quarters in the upper between-decks forward. Aft, on the same deck, she had sail-rooms, accommodations for her petty officers, berths for thirty boys, workshops, and store-rooms. The forward cabin or dining-saloon, and the state saloon, were tastefully decorated. Abaft the saloon was a vestibule, which contained the captain's cabin, on the starboard side, and the chief mate's opposite. The after-cabin was elegantly finished. The space between her forecastle and store-room aft, contained her spare spars, cordage, blocks, &c., and still left room for 400 or 500 tons of light cargo.

The ship herself was a wonder of strength. Her frame was of the best seasoned white oak, and was coaged or dowelled together, and bolted through the coaging. Her frame, before ceiling, was diagonally cross-braced with iron, the braces 4 inches wide, 1 inch thick, and extending from the floor-heads to the top-timbers. These were let into the frames and ceiling, were bolted through every timber, and riveted together at every intersection between the frames. She was built of 2056 tons of white oak, 1,500,000 feet of yellow pine, had 1650 knees, 230 beams, 336½ tons iron, and 56 tons of copper. She was thoroughly ventilated, had four hold-pumps, a fire-engine for wetting sails, or, in case of accident, for extinguishing fire.

She was very snugly and very strongly sparred, and, like a ship

of war, had nothing above the royals. She had four masts, named the fore, main, mizen, and spanker masts. The last was fore and aft rigged; the others were square rigged. Her sails were made of cotton duck, and she would spread about 16,000 yards in a single suite.

This vessel was designed, modelled, and built by her owner, Donald M'Kay, and it was confidently believed that she would prove the swiftest ship in the world. Although she registered over 4500 tons, she could stow at least 6000 tons, and such was the buoyancy of the floor, that she did not draw more than 23 feet water when fully laden with a general cargo.

This immense ship was consumed in a fire which destroyed upwards of a million dollars' worth of property. The conflagration first commenced in Front-street, and extended on both sides. Some of the sparks of the burning buildings were blown into the sails of the *Great Republic*, which was lying in an adjacent dock, nearly ready to sail for Liverpool, and, in a very short period, she was a mass of flames.

The sails of the *Great Republic* were partially unfurled, preparatory to her departure on her first voyage; and, in consequence of the extraordinary height of the mast, the engines produced little effect at first. The flames, which had begun to be under control when the foremast fell, burst out afresh instantly, and raged with uncontrollable fury. The vessel was now a perfect wreck, being soon one mass of flame abaft the mainmast. The loss by the destruction of the *Great Republic* and cargo will probably reach the amount of 700,000 dollars.

The foremast of the *Great Republic* first went by the board, falling with a terrible crash, and threatening the lives of the firemen standing on the side of the vessel. The mainmast then fell across the pier into the dock.

THE CRYSTAL PALACE AT SYDENHAM.

In the *Year-book of Facts*, 1853, we gave an outline of this new Palace for the People, wherein Art and Science will be represented with fitting grandeur. The plan of the undertaking having, however, been greatly extended; the original proposal as to the time of opening could not be adhered to, but the building, and its chief contents, are fully expected to be ready by May next. Meanwhile, it may be stated that the grand scheme will comprise all that was done in 1851, for the illustration of modern art and manufacture; with the addition of an extensive museum of ancient and mediæval art from all countries; of minerals, representations of antediluvian animals, and specimens in all branches of zoology aud botany. It is proposed to illustrate ethnology, by the representation of individuals of all races, habited and placed as they lived.

The Building, though shorter than that in Hyde Park, greatly exceeds it as a structural work. The chief differences are in the increased heights in each part, the introduction of two additional transepts, and the greater dimensions, generally, of the central transept, the arched roofs throughout the centre divisions; and the projection, internally, of pairs of columns, 22 feet apart, in advance of the general line, for the support of the main arched ribs, at distances of 72 feet in the length of the building. Some of the chief defects of the old building are therefore got rid of; but the equal repetitions of the same castings, and of stories, are retained, as well

as flat roofs to the aisles. On the garden-side has been introduced an under story, rendered necessary by the slope of the ground. This will be devoted to machinery. On that side is a noble terrace, with flights of steps and sculpture. The magnitude of the mass, and the main outline, are striking: of these, however, the vignette in the title-page of the present volume presents but a picturesque *bit.*

The structural character of the palace is given nearly as above in the *Companion to the Almanac.* We have taken some pains to ascertain how far the works have progressed to the time we are writing (Jan. 26), and we find the report to be as follows:—

The building is completed, except the centre transept, of which the garden end is not yet glazed; and, except a few openings at the Sydenham end, not yet filled up; half of the nave is floored, and filled with casts.

Of the basins in the nave, the foundations are up to the floor-line; the fountains are in a very forward state; and the crystal fountain for the Norwood end is completed.

The Heating Apparatus is in action, an artificial temperature being maintained at that end of the building where the plants are stowed; the pipes of the heating apparatus extend 50 miles.

Of the Towers, one is completed; the other to half the intended elevation. The Norwood wing is far advanced, and the Sydenham wing is commenced.

The Terrace Gardens are marked out, and the Basins for the fountains are commenced; and some of the statues are fixed on the balustrades. The first circular basin is nearly finished; the cascades are receiving their decorative stone-work; and the range of basins to contain large fountains are very forward. These fountains will consist each of 90 jets, the centre one 240 feet high; each as high and large as the steeple of Bow church, Cheapside. The Geological Islands are being rapidly completed.

Of the Courts, the Pompeiian is finished; the Egyptian, Greek, and Roman, are all nearly coloured, and will be immediately ready for their contents. The Alhambra walls are also nearly finished, and colouring to begin at once; the Fountain of Lions is ready. The Assyrian Court begins to assume a very noble appearance. The Mediæval, Gothic, and Modern Courts, are in a forward state.

On the shores and islands of the lake are to be dispersed models of the extinct and singular monsters of the wealden and neighbouring periods. Huge chelonians are to bask upon the banks; the plesiosaur, with its reptile form and bird-like neck, is to repose in the mud; the megalosaur, the most gigantic of lizards, is to rear its portentous form among the rushes; and the enormous iguanodon, half elephant, half crocodile, measuring 100 feet from his snout to his tail, is to exhibit himself as the true prototype of the dragon of antiquity. We have seen these models, and we are glad to bear witness to the admirable skill with which Mr. Hawkins is investing Portland cement with the similitude of these hideous giants of a former world.

NEWALL'S RAILWAY BREAK.

THIS Break has been for some time in use on the East Lancashire Railway, of which Mr. Newall, the inventor, is the carriage superintendent. The apparatus consists of break wheels fixed at the back of different carriages, which are connected together over the tops of the carriages by rods, having flexible joints and sockets, so as not to be too rigid in rounding curves, and to accommodate the extension or contraction of the length of the train. The whole of these wheels are connected with one on the engine, under the control of the engineer, and with others in the guards' vans, back and front; either of those parties having the power to put on the break, which is instantly applied to every carriage to which it is attached by the pressure of blocks on the wheels.

PREVENTION OF RAILWAY COLLISION.

MR. J. V. ASBURY, of Enfield, Middlesex, has patented an invention, the object of which is to diminish the injurious effects of Railway Collisions. Mr. Asbury proposes to make the longitudinal frame pieces of the carriage no longer than that part of the carriage which is appropriated to the accommodation of passengers. This affords a large space for the pressure upon the buffers to act through before the carriages are subjected to impact. The forces of collision are received upon buffers, the rods of which are connected with, and made to act upon, spiral springs, and blocks of India-rubber, arranged in cylinders beneath the bottoms of the carriages.

RAILWAY ACCIDENTS.

THE following table shows the comparative statement of Casualties upon the Railroads of Great Britain and New York, in proportion to the whole number of persons travelling:

	Great Britain.	*New York.*
Passengers killed	1 in 2,785,491	1 in 286,179
Employés killed	1 in 742,797	1 in 124,010
Others killed	1 in 1,392,714	1 in 45,929
Passengers injured	1 in 234,568	1 in 90,739
Employés injured	1 in 1,128,427	1 in 83,603
Others injured	1 in 3,301,323	1 in 79,155
Total killed	1 in 412,665	1 in 43,454
Total injured	1 in 183,406	1 in 28,078
Killed and injured	1 in 126,973	1 in 17,425

IRON SLEEPERS.

MESSRS. DAY & LAYLEE, of Ashford, have patented a new mode of constructing Semi-tubular Wrought and Cast-iron Transverse Sleepers for railways. The sleepers are laid with their concave side downwards; and in those of wrought-iron an opening is left in the centre, for the purpose of facilitating the perfect packing of the sleeper, and passing other rails for crossings, and also for convenience of drainage, In the cast-iron sleeper this is accomplished by casting it in two

pieces, and connecting them by means of wrought-iron bars. Openings are left in the wrought-iron sleeper to receive the rail-seating, which is of cast-iron, in two pieces, a wooden key being used to tighten the rail in the usual manner. In the cast-iron sleeper, the seating or chair and the sleeper are in one casting. It is said that to each 15-ft. rail, the bearing surface of the sleepers will be 11½ ft. It is presumed that by this plan the maintenance of the permanent way will cost less than one-half that of a line where ordinary wooden sleepers are used. The ready means of packing at the two ends, and from the central opening, will, it is said, save labour; and the bearing surface of the sleeper being near the top of the ballast, a less thickness will suffice. The form of the sleeper, too, it is thought, affords facility for a more perfect drainage than if it were solid; added to which, the seating for the rail being 10 inches long, a greater bearing is obtained than with the ordinary chairs.—*Mining Journal.*

M'CONNELL'S EXPRESS ENGINES.

THE great capabilities of the new Express Engines constructed by Mr. M'Connell, of Wolverton, for the traffic of the London and North Western Railway,* have been shown most satisfactorily, in a trip wherein one of these engines brought an experimental train, consisting of not less than thirty-four carriages, loaded to five tons each, from Birmingham to London in three hours. This is considered to be the most extraordinary performance ever accomplished by a single locomotive engine, and has confirmed the expectations formed of the merits of the arrangements recently patented by Mr. M'Connell. In many parts of the journey the speed had to be much diminished in consequence of the bad state of the road; and there is no doubt, when these defects are remedied, the two hours' trip, with a train of fifteen carriages, will be carried into effect.

STATISTICS OF AMERICAN RAILWAYS.

A VALUABLE Report appended to the American Census Returns furnishes some interesting statistics respecting the Railroads of the United States—from which we deduce the following facts:—At the commencement of 1852 there were 10,814 miles of railroad completed and in use, and 10,898 miles in course of construction. About 1200 miles of new railroad have been completed during the past year, and about 2000 miles of new road placed under contract; so that the railroads completed on the 1st of December would be 12,014 miles, and those in progress are increased to 12,898 miles. The total amount invested in railroads made and projecting is set down at 672,770,000 dollars. The average rate of fares on the railroads are less than 1*d.* per mile.

RAILWAY TUNNEL THROUGH THE ALPS.

A CORRESPONDENT of *The Builder* has communicated to that ably-conducted journal, the plan of the Chevalier Maus for forming a Tunnel through the Alps; prefacing his account with a short descrip-

* Described in the "Year-book of Facts," 1853, p. 26.

tion of the route he considers it best to adopt, and a few other particulars.

The line of communication selected by M. Maus skirts the southern side of the Mont Cenis, following the valley of the Dora, and passes by the towns of Susa, Oulx, Bardoneche, &c.; thence by means of a tunnel under the ridge of the Alps it proceeds to Modana, a town situated in Savoy, on the west of that extensive chain of mountains, by a route only thirty miles in length; while the existing thoroughfare over the Mont Cenis pass is nearly forty miles, so that a saving of about ten miles would be at once effected between Susa and Modana; and the time required to travel between these two places would, in the event of this project being put into execution, be reduced from eight hours (the time which the mail takes to go by the present road) to one hour and a half, a very moderate calculation for the railway—being only at the rate of twenty miles per hour.

Thus the portion of the great Savoy trunk line of railway projected by M. Maus, would commence on the Italian side, at the town of Susa, near the confluence of the Dora with the Cenisis, a rapid stream that takes its rise in the Mont Cenis; and would form a continuation of the Turin and Susa railway, now in course of construction: the line would then pass to the right of the village of Gioglione and over the high grounds of Chaumont, where the mountainous character of the country involves the necessity of two tunnels, which are, however, of minor importance, the one being about 3040 yards in length, and the other only 330. A short tunnel will likewise be necessary at the Fort of Exilles, in order to avoid some of the outworks; and farther on, another tunnel, which, however, will be only 2230 yards long. We thus arrive at Salbertrand, situated ten miles from Susa and nearly 1670 feet above its level, which gives for this portion of the line an average ascending gradient of 1 in 31. Beyond this, passing Oulx, Savoulx, Beaulard, and even for some way farther on than Bardoneche, the surface of the country is remarkably uniform, and will not present any difficulty: the length of this section is about eleven miles, and its average rate of inclination 1 in 57. The remaining nine miles is a descending gradient of nearly 1 in 57, likewise. And here the line obtains a passage beneath the Alpine ridge by a tunnel of about eight miles in length, at a depth of 5248 feet, or as nearly as possible a mile below the surface of the pass.

The three principal gradients above mentioned being divided into others, to suit the nature of the ground, the rate of inclination on some portions of the line will be steeper in certain cases than those named, but in no instance will they exceed 1 in 28. Throughout the whole length of the principal tunnel the gradient will be 1 in 53.

M. Maus estimates the cost of the work at £1,400,000.

As the projector considered that the great difficulty in the way of carrying out this bold conception would be the amount of time and labour which, according to our present system of conducting such operations, it would necessarily require, he has contrived an excavating machine, for facilitating the labour, and which, at the same

time, is calculated to expedite in a very great degree the execution of this and similar works; and from the success which has attended the trials he has already made with it, he states that he has no hesitation in fixing five years as an amply sufficient period for the completion of the projected tunnels, working at both ends at the same time, although without shafts, which the height above renders impossible.

The excavating machine consists of a frame, in which are set a number of very broad chisels, having projections on their face, acting somewhat after the manner of the hammer used by masons to restore the rough surface to the granite pavement in London when worn smooth by the traffic.

The chisels are so arranged as to cut into the face of the rock, at the extremity of the heading, five horizontal grooves, and two vertical channels bounding the former, and at right angles thereto. These grooves or channels are run one into the other, and serve to insulate four rectangular blocks of stone, which will then remain attached only by one of their planes to the solid mass of the mountain-rock, from which they may readily be separated by wedges, driven with heavy hammers into the grooves.

These blocks will be about seven feet long, three feet wide, and eighteen inches in thickness.

The machine acts only upon half the width of the heading at a time, so that while it is at work cutting the grooves which separate the blocks of stone at one side, the workmen are engaged in removing those already cut in the other half-width of the heading.

When the machine and the labourers have each completed their tasks, they mutually change places. The machine again sets to work to shape out new blocks of stone, and the workmen proceed to detach those which have just been cut, beginning by inserting the wedges at the top of the heading, and proceeding downwards: by thus prizing the stones, they are easily separated from the rock, after which they are placed on trucks, and conveyed to their destination, so that the space is again left clear for the machine to recommence its operations.

The excavating machine cuts the channels in the rock by means of several series of chisels placed one beside the other, in straight lines. These lines of cutting tools are so arranged as to be capable of a slight lateral motion in the direction of the grooves after every stroke: the object of this is to bring the chisels to bear upon all the spaces lying between the several cutting-tools situate in the same line, so as to produce, not a succession of holes, but a continuous channel similar to a very wide saw-cut.

This lateral shifting of the lines of chisels, which takes place alternately from right to left, and from left to right, is caused by a corresponding motion given to the frames in which they are fixed. Each chisel is driven against the rock by a spiral string coiled round it, and which produces an effect similar to that caused by the muscles of a man in the act of throwing a javelin. This spring, driving the chisel forcibly against the rock, obliges it to act efficaciously, notwithstand-

ing the slight inequalities at the bottom of the channel, arising from a want of uniformity in the resistance of the stone.

When the machine is in operation, the several lines of chisels are all drawn back simultaneously, by means of a species of cam, or movable bar, which acts against projections formed on the cutting instruments. This, by forcing back the chisels, and thus compressing the above-mentioned springs, leaves them in a position to exert a strong percussive force as soon as the pressure is removed. This is effected by suddenly raising the bars, by means of an inclined plane, situated at the proper place for the end of the stroke. As soon as the blow has been struck, the springs are again immediately compressed as before, and the process is continued until grooves have been worked to the requisite depth into the solid substance of the rock.

Although all the chisels in each row are similarly acted upon by the movable bar, they are, nevertheless, completely independent one of the other, so that they may each be removed at pleasure, without interfering with the motion of those adjacent, or even suspending the operations of the machine; and if it be observed that one or other does not act efficiently, such may be removed, and new chisels substituted in their stead, without causing any delay or cessation.

The back-and-forward motion of the bar, which performs the functions of a cam, by pushing against the projections with which the several chisels are furnished, is caused, through the intermediation of rods and cranks, by two rotatory drums, which themselves are made to turn by an endless rope, communicating with a water-wheel, or other suitable motive power, situated at the entrance to the heading. The apparatus is arranged so as to enable the chisels to strike 150 blows in a minute.

The machine, at the same time, sets in motion a pump, which forces a constant supply of water into a reservoir, the upper part of which is filled with compressed air. By this means, the water is driven out in jets, through small pipes placed between the chisels, and is thus made to play upon the grooves, where it performs the double office of preventing the cutting instruments from getting heated, and removing the dust and chips of broken stone, which would otherwise accumulate in the grooves, and thereby prevent the effective working of the excavator.

The manner in which the engineer proposes to provide for a proper supply of fresh air during the progress of the work, is by means of a tubular ventilator, which he intends to lay along the bottom of the gallery. At given intervals throughout its entire length, according as they may be found necessary, he would insert fans, which he suggests might be placed on the spindles or shafts of the rollers or sheaves over which the endless rope is made to pass, so that they could constantly be worked with very little additional expense. These fans would force the air from one chamber of the tube into that immediately succeeding it; and as the ventilator would be made air-tight throughout its whole length, and only open at its extreme ends, so

that the air introduced through the tube may pass out through the heading, he considers that a constant current of pure air would thus be continually maintained in the tunnel, which, by its uninterrupted circulation, would cause such incessant, successive displacements, as to prevent any possible accumulation of noxious gases or unoxygenated atmosphere.

Mr. Robert Stephenson, the eminent English engineer, when passing through Turin, on his way to Egypt, in the month of September, 1850, went to see the experimental machine, then in operation at Valdoc, and M. Maus says he recalls with much pleasure the approbation and encouragement given him by our distinguished fellow-countryman, who, in a letter addressed to the Sardinian Minister for Public Works, stated it as his opinion that it would be advisable for the Government to make a trial of the excavating machine on an extensive scale.

The exhausted state of the Piedmontese exchequer, consequent upon the war with Austria, and the expenses of the great works connected with the line of railway between Genoa and Turin, have hitherto precluded the possibility of putting the invention to the test of practice in the actual execution of the works proposed. Nevertheless, now that the question of forming lines of railway through the Alps is every day becoming of greater importance, the time is probably not far distant when we shall see active measures taken for the realization of this important proposition.—*Builder*, No. 539.

RAILWAY ACCIDENTS.

M. Herman, chief engineer of the Orleans Railway, has invented a means of Warning Engine-drivers of Accidents which occur to trains in motion. A loud alarum is placed at the head of the train, and it is put in communication with an electric pile in such a way that, as long as an electric current plays uninterruptedly upon it, it remains immovable, and when the current ceases it rings. The current is obtained by passing two wires, covered with gutta percha, beneath the wagons, and continuing them from one carriage to another by means of small chains placed in the large connecting chains, these chains being so fixed that they unite the moment a carriage is attached to a train. To cause the current to be uninterrupted, the wires or chains of the last wagons of the train are connected. If, then, any accident occurs to break the wires, the current becomes interrupted, and the alarum rings. The box of each conductor is provided with a sort of break, which enables him to remove or break the wire in case of accident. The experiments which have been made have been quite successful, and the cost of the whole apparatus is very slight.—*Galignani's Messenger*.

ORDNANCE RAILWAY CARRIAGE.

Mr. Anderson, C.E., of Edinburgh, has designed an Ordnance Railway Carriage, which resembles in construction a railway truck or tender. Upon the carriage is mounted a heavy piece of ordnance, to be worked by three men, and capable of rapid successive discharges.

The artillerymen work under the protection of a large bomb-proof shield, from an aperture in which the gun is pointed. The carriage being at rest, the sides are turned downwards, and are fixed in the ground, giving a steadiness to the carriage, and forming a fender to protect the wheels. The platform of the carriage can be moved completely round, on the principle of the turn-table, so that the gun may be directed to any point. Mr. Anderson proposes to make the carriage twenty-one feet long and twelve feet broad, and capable of carrying thirty tons, although he would not generally put upon it more than ten or twelve tons weight. He proposes only to mount on it a 32-pounder, although it would be capable of conveying a 64-pounder —the largest piece of artillery in the service. The railway fort might also carry twelve artillerymen, who, armed with Minié rifles, might do deadly execution among the enemy. The machinery for assisting the loading of the gun, and for turning the battery upon the enemy, is simple and ingenious; but supposing it to be thrown out of gear, the inventor showed that the object might be effected by means of hand levers. Mr. Anderson estimates the additional mileage of railways required for his plan at about a hundred, great proportions of the coast, as he remarked, being too iron-bound and precipitous to render a landing easy, or, indeed, possible. About two hundred of these ordnance carriages would be sufficient, he thought, for the protection of the whole British coast, and, of course, great numbers of them could be speedily concentrated upon any point, and made to act with combined effect in opposing a hostile landing. The expense of carrying the plan into execution would be something less than half a million, but he considered that such a sum spent in this way would be more efficacious than if expended upon the navy. The Tay is already supplied with railway lines on both sides, from which these locomotive batteries could defend the river, while the construction of a few additional miles would place the whole coast from Granton to Berwick in as favourable a position.

NEW PIECE OF ORDNANCE.

A PIECE of Ordnance for Batteries and Ships, has been invented by Robert Armstrong, 1st Dragoon Guards, Dublin. Its superiority over the old battery guns consists in its being capable of being brought to bear upon any object within an angle of ninety degrees, without the necessity of moving its carriage; therefore fewer men will be required to work it. A ship armed with guns of this description could bring the whole of her broadside to bear upon any small object within the angle of ninety degrees, without moving a single carriage. It is particularly adapted for bow and stern chasers. A ship, either pursued or pursuing, could bring at least two-thirds of her broadside to bear upon her enemy, without altering her course one single point, which could not be done with the ordnance now in use. In the event of a bombardment, every gun, in the short space of two minutes, could be converted into an inverted mortar if required. In batteries they possess the same advantages over the guns in present use, as at least three or four men less will be required to work them.

as there will be no lifting to the right or left with handspikes; the metal of the gun is all that is moved when required to fire either to the right or left. He has also invented a field-piece on the same principle; a battery of which, when brought into action, will not require to have their carriage moved unless a change of front is actually required, and in which the sliding scale in the breech is dispensed with altogether.—*United Service Gazette.*

LOCOMOTIVE BOILERS.

MR. W. FAIRBAIRN has read to the British Association, "Experimental Researches to determine the Strength of Locomotive Boilers, and the Causes which lead to their Explosion." These experiments were undertaken in consequence of the explosion of a locomotive boiler in the engine-house of the North-Western Railway Company at Manchester, by which several persons were killed, and a great part of the roof of the engine-house was destroyed. The immediate cause of the accident was the carelessness of the engine-driver, who had screwed down the safety-valve, to stop its noise whilst he was talking to a companion, and had forgotten to unscrew it. In twenty-five minutes from the time the valve was closed the boiler burst. The Government Inspector who examined the wreck of the engine, was of opinion that the stays had been defective, and that the boiler had not been sufficiently strong for its work. Mr. Fairbairn, on the contrary, thought that all the parts had been strong enough to resist six times the ordinary working pressure, and that the explosion could not have been produced by the accumulated generation of steam till it had arrived at a pressure of at least 300 lbs. on the square inch. In consequence of this difference of opinion, a series of experiments were instituted to determine the real causes of the explosion, and to register those facts for future guidance in guarding against such catastrophes. The elaborate paper which details these Experiments will be published in the Association's Report.

THE NIAGARA SUSPENSION BRIDGE.

WE quote from the *Lockport* (U.S.) *Journal,* the following:—"Imagine a span of 800 feet in length, forming a straight hollow beam 20 feet wide and about 18 feet deep, with top, bottom, and sides. There will be an upper floor to support the railroad and cars, 20 feet wide between the railings, and suspended by two wire cables, assisted by stays. The lower floor, 19 feet wide and 15 feet high in the clear, is connected to the upper floor by vertical tresses. The cohesion of good iron wire, when properly united into cables or ropes, is found to be from 90,000 to 130,000 lbs. per square inch, according to quality. The limestone used in constructing the towers will bear a pressure of 500 tons upon every square foot. The towers are 60 feet high, 15 feet square at the base, and 8 feet at the top. When this bridge is covered with a train of cars the whole length, it will sustain a pressure of not less than 405 tons. The speed is supposed to add 15 per cent. to the pressure, equal to 61 tons. The weight of superstructure added, estimated at 782 tons, makes the total aggregate weight sus-

tained 1273 tons. Assuming 2000 tons as the greatest tension to which the cables can be subjected, it is considered safe to allow five times the regular strength, providing for a weight of 10,000 tons. For this, 15,000 miles of wire are required. The number of wires in one cable is 3000; the diameter of cable about 9¼ inches."

SUSPENSION BRIDGE OVER THE ST. LAWRENCE.

FROM "A Report on a Railway Suspension Bridge over the river St. Lawrence, near Quebec, made for the city council, by order of N. F. Belleau, Esq., mayor of Quebec, by William Serrell, C.E.," we learn that three sites for the proposed bridge were surveyed; one near the river Chaudiere, about four miles from the mouth of Cape Rouge Creek, another from Durham Terrace to Point Levy, and a third from a few hundred yards above Cape Diamond to the opposite shore. The result of which surveys or examinations is, that Mr. Serrell sees the entire practicability of a bridge for railway and other travel, and "that, too, within the means at your (the city council's) command." The site selected near the Chaudiere will require a bridge of 3400 feet. The plan proposed is a wire suspension bridge, consisting of two massive towers of masonry, built in the river in 12 feet deep of water at average low tide; these towers to be in total height from their base about 330 feet, and 52 by 137 feet square at the base, battering regularly upwards, and they will be 1610 feet apart at their centre. The height of the roadway above high water is to be 162 feet; the roadway will consist of two carriage ways, each 10½ feet wide in the clear, and a railway track of such width or gauge as to match the railways which may connect with it; the entire width of the road being 32 feet in the clear inside the parapet.—*Montreal Herald.*

"HIGH BRIDGE," PORTAGE, NEW YORK.

ON the Buffalo and New York City Railway is an immense but slender-looking wooden bridge, like a tramway on a very high scaffolding, which spans the Genesee Valley at Portage, in Wyoming county, and forms the chief object of interest on that line. An illustration of this bridge, and some particulars in reference to its construction, are given in the *Canadian Journal and Record of the Canadian Institute,* from which we quote the following details.

The bridge was designed by Mr. Silas Seymour, the chief engineer to the company. The piers on which the trestles rest are of ashlar masonry, of compact sandstone: their base is 75 feet by 15 feet: they are carried up with a slight batter to a height of 30 feet above the bed of the river, and coped with limestone blocks. Upon these are placed the timber trestles, connected with each other by a system of braces and girders.

The trestles are 190 feet in height, from the top of the piers. At their base they are composed of twenty-one vertical posts, 14 inches by 14 inches, diminished in number to fifteen at the top; and in size to 12 inches by 12 inches. The lateral and longitudinal braces, and also the girders, are 6 inches by 12 inches. Each trestle or pier is

said to be calculated to sustain a weight of 1000 tons in addition to its own.

The trusses resting on the top and connecting the several trestles or piers (which are 50 feet from centre to centre), are 14 feet in depth, and are composed of three framed girders with main counter and sway braces, in the usual manner. On the top of the trusses the track is laid.

The piers or trestles were commenced on the eastern bank, and as each trestle was completed the trusses were placed on them and the track laid; upon which a travelling crane was advanced, overreaching the space to the next trestle, and by means of which each stick of timber was let down to its place, until the whole of the next pier was completed, when the truss was placed and the crane advanced as before.

The whole length of the bridge is 800 feet, and each span (with the exception of that across a canal, which is 54 feet) is 50 feet. The arrangement of the structure is said to be such, that any particular piece can be taken out and replaced. Against fire, tanks of water are placed at convenient distances, and watchmen are employed day and night.

The total cost of the bridge was about £35,000, and the quantity of material employed in its construction as follows:

Masonry	9,200 cubic yards.
Timber	133,500 cubic feet.
Wrought iron . . .	49 tons.

It was estimated that the cost of a stone viaduct would have been about £250,000, the interest of which, at seven per cent., would renew the present structure every two years; and that the interest on the cost of a wrought-iron tubular bridge, of 500 feet span, with stone piers and suitable approaches, would renew it every third year. The masonry was commenced on 1st July, 1851, and the first locomotive passed over it on 14th August, 1852. The contractors were Messrs. Lauman, Rockafellow, and Moor, who were also the contractors for the whole line, and have long been connected with public works.—*Builder*, No. 528.

IMPROVEMENT IN BORING OPERATIONS.

From the *Miners' Journal*, published at Pottsville, Pennsylvania, we learn that an improved Boring Apparatus, patented by Mr. Knight, has been severely tested, by boring into the face of a granite rock 18 feet depth, and 24 feet in diameter, at the rate of 18 inches per hour. The framework of the machinery could not be properly fixed at first commencing the cutting; but when the excavating had entered about 50 feet, it was to be connected by sleepers and braces, as firm as the rock which it was cutting out. The patented apparatus has been adopted by the North American Coal Company, who have employed it to bore to a seam of bituminous coal, called the "Big White Ash Vein," which they expected to win at a depth of about 50½ fathoms. The hole was 4½ inches diameter, which was drilled at the rate of 11 feet in five hours. The machine was so arranged that

ten drills could be worked in a certain space at one time by any motive power; and the *debris* was washed up by a current of water from a pump worked by the same engine. Mr. T. S. Ridgway, mining engineer, of Minersville, states, that during the winter of 1848 and spring of 1849, he employed this machine in boring the Artesian well at East Boston for the Land Company, which worked well to a depth of 325 feet, but where not sufficient water was found, the stratum being a hard clay-slate, overlaying the primitive rock. The patentee is prepared, we understand, to sink shafts to any depth, and in any strata, in half the usual time of those performed by hand-labour, and at about one-third the expense. The operation of drilling through hard rock is one of considerable importance, and if this apparatus effects all the advantages which are claimed for it, the invention will prove of considerable value to the mining world.

BORING THROUGH MOUNTAINS.

A GREAT Tunnel Borer has been invented by Mr. E. Talbot, foreman in the great machine factory of Woodruff and Beach, of Hartford, U.S. The borer, worked with its own machinery, is an engine of 60-horse power. This drives four piston-rods, horizontally, and these turn four half-circle plates, of stout proportions, on which circular revolving blades are set. These four plates are turned with exactness about one-fourth of a circle and back, and are all set upon a revolving plate, of about 10 feet in diameter; and, thus set, cut a cuticle of 17 feet in diameter. The machine weighs about 80 tons, and is of stout proportions throughout. The motion obtained by this invention is novel—entirely new. By it the revolving knives, each running its quarter circle, cut completely from the centre to the circumference, and they do their work steadily and surely, cutting a round hole as they are turned by the large or centre plate.—*New York Journal.*

SUBMARINE TUNNELS.

MR. LOCKE, of Portsmouth, proposes that a tunnel of this kind shall be constructed of strong plates of iron, having at intervals girders of a considerable thickness. The several parts could be fitted at the factory, and having been transported to the point from which it may be proposed to construct the tunnel, could there be joined together in sections, and floated to their destinations, where they could be readily and gradually sunk by admitting water. The soil at the bottom of the water would have to be previously levelled and prepared; the workmen in this and all the other operations under water being accommodated in a diving-bell or with diving apparatus. After the whole tunnel shall have been completed, the water can be drawn out by engines at either end, and the fitments necessary for a road or railway completed. Should such a tunnel be of considerable length, and exposed to much violence from the water, it would require strong piers at intervals to keep it in its place.

The above description is necessarily very short, and the practical engineer will at once see difficulties that will have to be encountered;

for instance, in laying the tunnel upon such a foundation under water as shall be sufficient to support the weight that is intended to be passed along it, and in such a way that the pressure shall not bear upon the tunnel to open the seams. But his experience will teach him how to overcome such impediments, and bring the project to a successful issue.

IMPROVEMENT IN LIGHTHOUSES.

Mr. R. Clark, of West Strand, has patented a new method of Illuminating Lighthouses, in which he proposes to adopt a single ring; by means of which he saves the expense of two rings, and at the same time secures an equally effective and powerful light—the combustive properties of the atmosphere being thereby brought into one focus, instead of being dispersed, and, to some degree, wasted among three. Existing lighthouses are generally constructed of thick ribbed glass, the quality of which tends rather to obstruct than to facilitate the passage of light. Mr. Clark's plan—and in this may be said to consist the originality and real utility of his invention—is to have the lighthouse fixed, not revolving, formed as a hexagon, and made of perfectly transparent glass, excepting the side facing the sea, which is to be a distinctive colour. By this means, the uncertainty which too often attends the seaman in navigating his ship along our coasts, as the result of the resemblance of one light to another, is completely obviated, and his position, as indicated by the colour of the light, ascertained with the utmost exactitude and safety. As, however, the primitive colours are few in number, to avoid the confusion which would necessarily arise from their frequent repetition, it is proposed to vary them in the following simple manner:—Say that the denoting light at Beachy Head were red, the next light eastward also would be red, with a well-defined blue or other horizontal line; the next, red with a blue or other diagonal line, and so on. Of course all these alterations would have to appear on the Admiralty charts and be made known to the maritime community; but inasmuch as changes in respect of single lights are of constant occurrence, and the process of publishing them to the world is in daily operation, no more than ordinary difficulty or inconvenience would be experienced on this head.

JET PUMP.

There has been read to the British Association, a paper "On an experimental apparatus, constructed to determine the efficiency of the Jet Pump, and a series of results obtained," by J. Thompson. Mr. Thompson, at the meeting in 1852, described a machine which he had contrived for the purpose of raising water from beneath the lowest available level of discharge by means of a supply of other water coming from a higher level. This machine he designated a jet pump, because it raised water by the action of a jet; and it had at first been intended chiefly to empty the pits of his vortex water-wheels or other submerged turbines when access to them is required for inspection or repairs. During the progress of

the trials, however, which were made of it for this purpose, it soon gave indications of having much more extensive uses, and of being likely to prove, in certain cases, an advantageous machine for draining swampy land or shallow lakes. The cases of this kind for which its employment was contemplated, are those in which the low ground to be drained happens to have adjacent to its margin streams or rivers descending from higher ground. With a view to determine its efficiency and its applicability in any particular cases of this kind, Mr. Thompson had recently constructed an experimental apparatus, in which a jet pump could be made to act subject to great variations in the ratio of the height of lift to the height of fall, and which was suited for indicating accurately the quantity of water lifted and the height of the lift, corresponding to each quantity of water allowed to fall through any given distance within the working range of the apparatus.

DRAINAGE OF A LOCH BY MEANS OF A SYPHON.

CULHORN LOCH, in the county of Wigton, was drained, under the direction of the celebrated Marshal Earl of Stair, more than 100 years ago, by a drain, or cut, in some places thirty-six feet deep, That operation still left about eight acres of water, above sixteen feet deep in the centre, and fully twenty acres of marshy ground, which could not be drained without more fall than the whole cut could afford. This marsh had long been considered an eyesore, being immediately in front of Culhorn-house, a seat of the Earl of Stair; but the expense of deepening the outlet, in some places through quicksand, seemed so difficult and expensive, that although often talked of, the operation was never undertaken. The present Earl of Stair, some time before his accession, was anxious to drain the marsh; and having set his mind to consider various plans which were suggested, his lordship appears to have succeeded by an operation which, it is believed, is new in the annals of draining, at least on so great a scale as in the present case—viz., by means of a large Syphon. The syphon referred to is 880 yards long (exactly half a mile), and is seven inches in diameter. It had drawn off nine feet deep of the water in the loch, which it was expected would give fall to enable the proprietor to drain properly the marsh already referred to, and to reduce the loch to an ornamental pond. The highest part of the syphon was then twenty-one feet above the surface of the loch, and the longest limb of the syphon was ten feet under the level of the water, giving ten feet of fall. The main part of the syphon consists of cast-iron pipes 5-8ths of an inch thick, with spigot and faucet joints very carefully joined and made air-tight with lead. The contract expense of the iron pipe laid, when complete, was 7*s.* 6*d.* per yard.—*Wigton Free Press.*

IMPROVED HYDRAULIC SYPHON.

THE principle of the new Hydraulic Syphon of Mr. F. C. Mouatis, according to the *Mining Journal*, is, that "the water is not lifted in one upright pipe, but raised by a succession of tubes (say 30 feet each),

with an accompanying cistern and valves, on the principle of the force-pump. One continuous piston-rod runs through the whole, passing through stuffing-boxes, and carrying a piston in each tube, and a continuous stream is thus produced on the application of motive power. The valves are of peculiar construction, free from friction, and the cylinder being only of the same diameter as the tubes, instead of twice the diameter, as at present generally in use, there is an avoidance of a cost of power from this source alone four times as great on the part of the atmosphere as that of the piston."

IMPROVEMENT IN HYDRAULIC RAMS.

THESE very useful instruments appear to be less appreciated in this, their native country, than in America, where they are being improved and modified for special or general purposes. The Scientific Committee of the Franklin Institute of Pennsylvania have lately reported on an Improvement of the Ram by Mr. J. L. Gatchell, of Elkton, Maryland. According to the reprint in their *Journal*, the first improvement submitted for examination consisted in the use of a chamber between the body of the ram and the air-vessel, in which chamber is placed a flexible diaphragm, depressed by a spring, but capable of elevation by the recoil, thus communicating the momentum of the water passing through the body of the instrument to that contained in the air-vessel; the principal advantage of this mode of construction being the making the ram "double-acting," that is, keeping the water in the air-vessel separate from that driving the instrument; so that the water of any flowing stream, although unfit for domestic or manufacturing use, may be made available for raising the whole supply of a good spring. This effect has been before produced, both by sliding pistons and by interposed columns of air; but the use of the flexible diaphragm, by its tendency to produce a vacuum in the chamber above it when depressed by its spring, enables the water to be lifted into this chamber by atmospheric pressure or friction, and this feature the committee regard as a novelty. It moreover appears probable that the mechanical action of this diaphragm will react upon the discharge valve, and thus have a tendency to prevent the stoppages which have so often been a cause of annoyance in the use of hydraulic rams. The second improvement presented was a method of further preventing these stoppages by placing a spring upon the head of the ram, so that it shall be slightly lifted at every rise of the valve. The third improvement was in the method of regulating the discharge of the water from the head valve, through a series of orifices around the circumference of a disc.

ARTIFICIAL BLOCKS FOR HYDRAULIC PURPOSES.

THE material called hydraulic lime, generally used for engineering works under water, is a silicate of lime, in a somewhat nascent state. A discovery has been made by M. Berard, of Paris, of a simple but most valuable process for manufacturing blocks for hydraulic purposes, and particularly submarine ones. The commonest argil is employed by

the inventor, which is a silicate with a base of alumina: a block of any required dimensions is, therefore, constructed of unburnt bricks, taken from the field, and stratified in layers, with fuel on some piles of bricks forming a grating. An outer casing of unburnt bricks a short distance all round the block is filled with powdered charcoal; the fire is placed at the base of the block; it soon rises and heats the mass to a temperature which will soften argil; the contraction causes sinking sand vacancies, which must be filled up as they occur. When sufficiently burnt, the outer casing, which will then be burnt bricks, may be taken down, and the block removed to its destination. It will be seen that blocks may be made of any shape or size, having no limit but the possibility of carriage; and, when the operation is properly conducted, the solidity of the substance is remarkable: it requires great force to break them; iron instruments will not scratch the surface, steel scarcely mark them; and as concentrated nitric or sulphuric acid, or the most energetic alkaline solutions, will not have the least effect on them, they will be indestructible under the action of sea or any other water.—*Mining Journal.*

HYDRAULIC POWER: "STEAM SUPERSEDED."

Mr. George Goodlet, Leith, has patented the means of working an engine by an effective impulse from the pressure of a column of water, say 33 feet in height, which, combined with the natural pressure of the atmosphere, will be equal to 30 lbs. on the square inch. The slide of the ordinary steam-engine valve is cut at both ends, to admit of a more constant entrance and exit of the motive agents; and with the aid of another valve for cutting off the fluid after the piston has received the blow, on the principle of the air-gun, a more powerful effect is produced on the piston than has hitherto been accomplished by the methods at present in use. To prevent a vacuum being formed on the induction-side of the piston, and to balance the opposing atmospheric pressure at the exit, Mr. Goodlet places a self-acting atmospheric vacuum-valve at each end of the cylinder-cover. The admission of air, adds the writer, into the cylinder in the manner described, on the return of the piston, will give elasticity to the water, and thus facilitate its escape.

WATER-METER.

A Water-measurer has been patented by Mr. Taylor, of Manchester. The instrument is simple, presenting outwardly something of the appearance of a dwarf steam-engine cylinder, and inwardly that of a common water-wheel, working horizontally instead of perpendicularly, in the cylinder, with two streams of water shooting from two points, inlets in the circumference of that cylinder, and communicating a rotary motion to the wheel by striking upon its boxes; attached to the pivot on which it works are a series of other wheels that work a dial, on which are registered the number of revolutions made according to the force of the column of water pouring in through the inlets. Of course, the quantity of water required to move the wheel and its machinery, is a matter of calculation.

NEW MODE OF GENERATING STEAM.

Mr. S. Cable, of St. Louis, has patented a New Mode of Generating Steam, by which he proposes to dispense with boilers altogether. His plan is to employ a metallic network, similar to Ericsson's, upon which, when in a properly heated state, jets of water will be thrown, and being immediately converted into steam, will be conveyed to the steam-chest, where it will be employed in the usual manner. The advantages claimed are economy in fuel and safety from explosion. How he proposes to restore the heat we do not know.—*Mechanics' Magazine*, No. 1549.

STEAM INDICATOR.

Mr. Hulford, of H.M. Dockyard, Woolwich, has invented an ingenious instrument for ascertaining from an Indicator Card, the Steam-pressure on the piston of a steam-engine. The indicator card being placed on the board, so that the atmospheric line coincided with the marks on the retaining springs, the triangular scale was placed at the bottom of the figure, and the side roller made to revolve, until the spiral line on it intersected the edge of the scale, in which position the roller was fixed. The distances between the steam and vacuum lines were taken, by sliding the scale along the figure, and ten or twenty divisions might be taken, according to the degree of accuracy required; the sum of the distances, divided by their number, gave the mean pressure on the piston. A great saving of time in the measurement of all irregular figures evidently resulted from the use of the instrument, and its simplicity and low price were also points in its favour.

COMBINED STEAM-AND-ETHER ENGINE.

Mr. G. Rennie has made to the British Association a communication "On the Combined Steam-and-Ether Engine," a French invention applied to propel a ship from Marseilles to Algiers, which he had lately examined. Mr. Rennie had been requested to investigate the working power of this engine, and, accompanied by his son, he made a voyage in the vessel from Marseilles to Algiers and back. The engine was originally intended to be worked by steam, and the boiler is adapted to an engine of 30-horse power. The principle of the construction as it it is now worked is this:—The heat given out by the steam in condensing, is applied to boil ether; the vapour thus generated is admitted into a distinct cylinder, and the work it does is so much gained from the waste heat of the steam. The condenser is surrounded by tubes containing the ether, which thus aids in condensing the steam; and as ether boils at a temperature of 100° Fahr., there is a tolerably efficient condensation of steam produced by the temperature at which the ether boils. The ether, after having done its work in its separate cylinder, is condensed in a refrigerator surrounded by cold water, and it is then again in a state to act as a condenser of the steam. The loss of ether vapour by leakage during this repeated vaporization and condensation, amounts in value to one franc per

hour. Special arrangements are made for dissipating the vapour that escapes, so as to prevent ignition, and with that provision Mr. Rennie considers there is no danger. In the return voyage, Mr. Rennie placed the coal under lock and key, and superintended the delivery of it, so that no deception might be practised; and he estimates the saving of fuel from this combination of ether with steam at nearly 70 per cent. It had been estimated by a French commission at 74 per cent. The French Government have paid the inventor, M. Dutromblet, a large sum for the invention; and they are about to put it in operation in a ship of 1500 tons burden, with engines of 150-horse power, which will have the advantage of the experience gained during the working of the present engine.

Mr. Taylor, jun., the son of the engineer who constructed the engine of the Marseilles boat, said that there were many defects in the present arrangement which would be remedied in the engines about to be made. The condensers are at present very imperfect, and do not expose a sufficient surface.

Mr. Sykes Ward said, that good ether does not corrode metals; wherefore there could be no objection to the employment of it on that account. The attempts that had previously been made to apply spirituous vapour as a motive power, necessarily failed; because, though alcohol and ether boil at a much lower temperature than water, their vapours are much heavier, and carry off as much heat at a given pressure, when applied, as steam.

Mr. Fairbairn stated, that in the best Lancashire steam-engines, when working expansively, $2\frac{3}{4}$ lbs. of coal per horse-power is the quantity consumed, which was nearly equal to the quantity consumed during the voyage from Algiers to Marseilles—whilst some of the steamboats on the Humber burn 10 lbs. of coal per horse-power; therefore, compared with that wasteful expenditure of fuel, the steam-and-ether engine presented great advantages.

Other members spoke encouragingly of the combined power; though the condensation of the steam, it was considered, must be imperfect, as the vacuum is not good at a temperature higher than 90°.

ROTATORY VALVE ENGINE.

At the late Meeting of the British Association was read "A brief Description of Locking & Cook's Rotatory Valve Engine, and its advantages," by G. Locking. In this engine a metal disc, with three apertures, slowly rotating on a flat surface, with corresponding openings connected with the boiler and the cylinders, supplies the place of the ordinary slide valves. Rotatory motion is given to the valve by a vertical shaft, on which there is a pinion that is worked by a cog-wheel on the shaft of the engine. The two bearing surfaces are ground steam-tight, and an outer casing serves to confine the steam, as in the common slide valve. The advantages said to be gained by this arrangement are the diminution of friction and a more ready means of cutting off the steam and of reversing the engine. As the rotatory valve has a continuous slow motion, the inconvenience and

friction occasioned by the rapid reciprocating action of the slide valve is avoided. Among other advantages of this contrivance, it was stated that it costs less, is less liable to get out of order, and occupies less room. Mr. Cook, the inventor, is a working mechanic in Hull.

Mr. Fairbairn, Mr. Roberts, Mr. Hancock, and other gentlemen, expressed themselves favourably of the invention; and at the conclusion of the business the members of the Section paid a visit to Messrs. Locking & Cook's works, to inspect a steam-engine constructed on this principle in action.

JENNINGS'S SLUICE-VALVES.

THIS improvement consists in simplifying the construction, by casting the "body" and the "faucet" ends in one piece, thus avoiding the use of bolts, nuts, and joints. The slide is first fitted, and made to work properly on the body of the valve; it is then removed, and, with two gun-metal faces, is turned, ground, and accurately fitted. The slide, through which a small hole has been previously drilled, is again placed in the valve, the two faces are introduced, and all firmly bolted together. The joints of the faces, which are dovetailed to the body, are then made with lead, or with iron cement; the bolt is removed, the hole plugged, and the valve is completed, at considerable saving of time and cost. These valves are stated to have been extensively used under considerable pressures.—*Proceedings of the Institution of Civil Engineers.*

SEAWARD'S PATENT MARINE ENGINE.

THE arrangement described under this patent is the invention of Mr. John Seaward, of the eminent firm of Messrs. Seaward & Co., of the Canal Iron Works, Poplar, and is applicable chiefly to engines employed for driving the screw-propeller. In engines of this description it has been heretofore the invariable practice to place the air-pump and condenser together in close conjunction; but as it is frequently the case that these parts of the engine are required to be situated at some distance from the cylinders, the consequence is, that the spent steam has to be conveyed to the condenser by means of a pipe of considerable length—a disposition of parts which is not only highly inconvenient, but also prejudicial to the rapid condensation of the spent steam. Mr. Seaward proposes to remedy these inconveniences by disconnecting or separating the condenser entirely from the air-pump, which latter he places in any convenient situation where a ready connexion with some moving part of the engine can be obtained to work the bucket; while he places the former in close contiguity to the cylinders, so that the spent steam may have the shortest possible distance to travel before being acted upon by the injection-water within the condenser; and he employs a pipe of convenient size to convey from the bottom of the condenser to the foot-valve of the air-pump the water arising from the condensation of the steam, together with the injection-water and the uncondensible air and gases, which will be drawn up by the bucket, and discharged through the

hot well in the usual way. For the details, with engravings, see *Mechanics' Magazine*, No. 1566.

COLD-WATER STEAM-ENGINE.

MR. E. T. TIPPETT is the inventor of the new engine thus entitled. The steam is produced without boilers, by simply injecting cold water into generators. The amount of steam required to force out or return the piston-rod is made by the introduction to the influence of the fire at each moment of precisely the quantity of water needed, thus doing away with the necessity of boilers. It is claimed that there is no possibility of an explosion, that greater power is obtained, and less room occupied for the necessary machinery. The water falls into the engine, being first raised by a force-pump into a reservoir situated above the engine, and thence inducted down as wanted. The engine is a singularly constructed piece of mechanism, both in appearance and mode of operating.—*Cincinnati Gazette.*

A MONSTER STEAM HAMMER.

IN the *Glasgow Herald* is described a Monster Steam Hammer, the largest in the world, we believe, and recently erected in Condie's extensive machine works in that city. The frame is composed of two cylindrical cast-iron colums of 19 feet long, tapering from 3 feet 5 inches in diameter at the floor-line, to 2 feet 3 at the capital, and weighing each 9 tons 13 cwt. These columns stand apart 23 feet, measuring from centre to centre. On the tops of the columns rests a cast-iron beam, measuring 2 feet 6 inches at its deepest part in the centre, and weighing 6 tons ¼ cwt.; a similar beam, but weighing 7 tons 1 cwt., runs across from column to column, at a height of 6 feet 10 inches from the floor line. Between these two beams the guides in which the hammer slides are placed, each of which weighs 2 tons 5½ cwt. The guides, and the upper and lower beams and the columns, are held firmly together by tie-rods that run diagonally from the tops of the columns to the bottom of the slides. The hammer is upwards of 6 tons, exclusive of the face, which is cast separate, and wedged into a dove-tailed slot, left for the purpose in the bottom. All the parts of this great tool weigh in gross somewhere about 50 tons. The foundation-work of such an enormous hammer, with its percussive shock every three or four seconds, was a matter requiring no ordinary forethought. The whole space under the machine, about 30 feet square, was first, at a great depth below the surface, closely filled with piles 20 feet long, and 10 inches in thickness. On the top of these piles there are 400 tons of stones, each 3 feet in thickness, dressed all over; and above this mass lies the anvil block, weighing no less than 53 tons. When this hammer was set up, it started with the regularity and smoothness of a piece of the finest watch-work. But when the huge mass of iron composing the hammer came down with its full weight, with a fall of 6 feet, then the almost volcanic force of the mighty weapon was understood. The shock caused the earth to vibrate for a considerable distance.

BALMFORTH'S STEAM-HAMMERS.

MESSRS. BALMFORTH, of Clayton, Lancaster, ironmasters, have patented some improvements relating to Steam Tilt-hammers, and which consist mainly in the employment of an oscillating steam-cylinder, having its piston-rod connected direct to the helve of the hammer-head, and beneath the helve in such a position as to allow clear access to the hammer from all sides. The axes on which the hammer tilts are furnished with screw bearings, to enable one side to be raised more than the other, and thus allow of irregularly-formed masses being forged. A modification of the machine enables it to be used for rivetting.

STEAM FIRE-ENGINE.

THE following description of the Cincinnati Steam Fire-engine has been communicated by Mr. T. W. Bakewell, who obtained it from Mr. A. B. Latta, the builder. We believe no previous authentic account has been published of this machine, which has excited considerable notice, and is probably destined to play an important part in the protection of buildings from fire.

This machine has been in operation since the first of January, 1853, and has proved itself successful beyond all doubt; although the project has been tried before, and set down as impracticable, because it requires a machine that can be brought into operation as soon as hand apparatus. This, with other objections,—such as running over rough streets, laying on uneven ground when at work, running up and down hill, and a host of other objections,—have been causes for abandoning the use of steam heretofore; but these objections have been completely set aside by the operation of this machine. The first thing of importance in this engine is the principle of generating steam, which is a very old principle, but has not been properly understood heretofore. It is the same that is now being projected by a Frenchman, which he calls a serpentine boiler, which is a continuous pipe coiled spirally or otherwise, so as to let the fire have a chance to surround it; the water being injected, it is instantly converted into steam; this accounts for the short time it requires to raise steam. This machine resembles a locomotive in some respects: it has cylinders on both sides, placed like those of a locomotive, the pumps being directly forward of the steam cylinders; the piston-rods run directly out of the steam cylinders, and enter the pumps; the engines are so arranged as to couple to the driver at pleasure; this is done in order to drive the machine by steam when desired, and to hold back when going downhill, or assist in going up; this is an important consideration. The drivers resemble those of a six-wheel locomotive, being aft of the fire-box. The forward end of this machine runs on one wheel, and revolves round like that of the velocipede, by which means the machine can be turned anywhere in the length of itself. Another reason why it should only have three wheels is, that its bearings are like those of a three-legged stool—it always comes to a bearing, without straining or twisting the machine; the perfect adaptedness of

this combination to suit the circumstances being the cause of its success. This machine is constructed of iron and brass, except the wheels which are partly of wood. The worst throwing it has ever made was 50 feet, when it was brought out to throw before the Hope House Company of Philadelphia; the greatest throw it has ever made is stated to have been 240 feet from the end of the nozzle to where the solid body of water fell, through $1\frac{1}{4}$-inch nozzle; and 291 feet to where the spray fell. This machine will discharge about 2000 barrels of water in one hour. It throws from one to six streams of water, and has two suctions $6\frac{1}{2}$ inches in diameter, and 24 feet long; each one is in one piece; these are always attached to the engine: they cross each other in front, and lay back on either side; this is a very important improvement, and a saving of time and labour in attaching the suctions. The time required to put this machine in operation is five minutes; it requires four men and four horses to operate it, and will do as much as six of the largest class hand-apparatus. This will give the reader an opportunity for estimating the economy in the use of steam for this purpose. Any further information can be obtained concerning it, by addressing A. B. Latta, who is the projector and builder of this machine, at Cincinnati.

Now, by way of illustration, we may notice its performance at one fire, to show the effect produced by this machine, compared with that by the hand-apparatus. A fire occurred on the 20th May, 1853, in Twelfth and Main streets, at three o'clock P.M.; the alarm was given, the steam-engine ran eight squares, laid her hose, which was one square from the fire, and put the first water on the fire, which was all done in about five minutes; the hand-apparatus, notwithstanding there were some of them stationed only two squares from the fire, were not at work until the steam-engine was under way. In eight and a half hours' work (making due allowance for waste of water) she poured into the fire about 15,000 barrels of water; it was a large brewery with sale-cellar; the wind was high, and nothing but a cataract of water could have saved the entire square from destruction. This will show what can be done with steam in putting out fires. Arrangements are now making for four more of these machines by the chief engineer of the fire department. This will give the fire department of Cincinnati the greatest strength of any in the Union.—From the *Journal of the Franklin Institute.*

NEW HARBOUR AT HOLYHEAD.

THE extensive works in progress at Holyhead were visited, in September last, by Her Majesty. The Harbour was commenced in 1849, and is intended to secure a total area of 300 acres for the purpose of a harbour, two-thirds of that space having a *minimum* depth of seven fathoms at low water. Accommodation will thus be provided for about 400 vessels of all classes, including seventy men-of-war as large as the Duke of Wellington. The north or great breakwater will be 5000 feet long, and 170 feet wide, and of this work 4000 feet have already been completed to low-water mark—3500 feet of it being from fourteen to fifteen feet above high water. The depth at low

water thus filled up is from forty-five to forty-eight feet; the stonework which surmounts it is about eighty feet above the foundation. The smaller, or eastern breakwater, which protects the harbour on the landward side, will be 2100 feet long, and 1000 feet of it have already been formed, in a depth of thirty feet at low water, and to a width of 100 feet. Since 1849, when the works were begun, 2,400,000 tons of stone, in blocks varying from ten tons downward, have been deposited in the sea, at the rate of from 22,000 to 27,000 tons per week, or from 4000 to 5000 tons per day. The quarries realize the idea of mountains removed and cast into the sea. As much as four tons of powder is frequently exploded in one mining operation, and thus 20,000 to 30,000 tons of stone are often at once set free. The plan adopted is to blow away a huge section of the base of the mountain, when the superincumbent mass of rock, 150 feet high, being unsupported, tumbles down after it. The rate of progress is 250 times greater than it was in the Plymouth breakwater. This economy of time has been effected by the use of piled stages carrying railways, which project boldly into the sea. The contract contemplates an expenditure of about £800,000, and the outlay so far is under £400,000. This sum, however, includes the purchase of the surrounding land.

NEW PRINCIPLE IN NAVAL ARCHITECTURE.

MR. BOURNE, the author of an excellent *Treatise on the Screw Propeller*,* suggests the combination of the Stern-screw with some form of the Side-paddle (in fine analogy to the fish-form and power), as an improvement that would enable ships to head the wind more powerfully than they yet do; and he points out what seems to us a most important principle of strength in shipbuilding—namely, that a ship ought to be regarded as a hollow beam, of which the deck is the upper side and the bottom the lower; so that it is the deck and bottom, and not the sides, which have to endure the strain; and, indeed, might we not venture to suggest that the strongest of all ships would be those built on the principle of a T girder, with a division for strength along the length of the hold at midships? In Mr. Bourne's view, the function of the sides is merely to keep the top and bottom in their right positions: it is, therefore, in the top and bottom that the strength should be collected—thus giving more strength with less weight. From a review of the progress of mechanical science, by Mr. Fairbairn, read at the last meeting of the British Association, it appears that "the construction of an immense steam-vessel has been undertaken by Mr. Brunel and Mr. Scott Russell, of such vast dimensions that it will stretch over two of the largest waves of the Atlantic, and will thus obtain a steadiness of motion which will be a preventive against sea-sickness. This mammoth steamer is to be 680 feet long, with a breadth of beam of 83 feet, and a depth of 58 feet. The combined power of the engines will be that of 2600 horses. The ship is to be built of iron, with a double bottom of cellular construction reaching six feet above the water line, and with a double deck, the upper and

* In a quarto volume, published by Longman and Co. 1852.

the lower parts being connected together on the principle of the Britannia Tubular Bridge, so that the ship will be a complete beam. It will thus possess the strength of that form of construction, and not be liable to "hogg," or break its back, as has been the case with other ships of great length. The double bottom will be a means of increased safety in other ways, for if by any accident the outer shell were broken, the inner one would prove effectual to keep out the water. As an additional security, however, it is to be divided into ten water-tight compartments. The ship will be propelled by paddles and by a screw, which will be worked by separate sets of engines. This ship will form, when completed, the most extensive work of naval architecture ever constructed." We are not aware that Mr. Bourne's name was mentioned in connexion with the project by Mr. Fairbairn, but we think it ought to have been.—*Builder,* No. 558.

STEAM NAVIGATION.

At the late meeting of the British Association at Hull, there was read a paper on the "Rise, Progress, and Present Position of Steam Navigation in that Port," by J. Oldham, who took a retrospective survey of the application of steam power to the propulsion of ships, with a view to prove that Hull has taken a prominent part in the introduction and improvement of the invention. In 1787, experiments were made in Hull, by Messrs. Furnace & Ashton, which resulted in the construction of a steamboat worked with paddles, that attracted the attention of the Prince Regent, by whom the boat was purchased —but it was soon afterwards maliciously burnt. In 1814, the first steamboat on the Humber was established, to run from Hull to Gainsborough: it was called the *Caledonia,* and it accomplished, under favourable circumstances of the tide, fourteen miles an hour. The first sea-going steamboat sent from Hull was in 1821; and it was supposed to be the first steamboat that plied on the east coast of England. The sea-going steamers that are now connected with the port of Hull have an aggregate tonnage of 9139, and 2749-horse power. The tonnage of the river-boats is 2218, with 1135-horse power. The other steamboats coming to Hull have a burden of 5909 tons, and 2236-horse power. There are altogether eighty steamboats trading with Hull, of which number fifteen are propelled by the screw.

A discussion arose on the respective merits of the inventors of steam navigation, and the priority of their inventions; in which discussion Mr. Fairbairn, Mr. Bayley, and Mr. Thompson took part. Mr. Fairbairn said, he saw the *Caledonia* enter South Shields, and that it was the first steamboat in the north after Henry Bell's on the Clyde. Bell, it was stated, got the idea of his engine from Symington, and he made propositions to our Government, and to Napoleon during the temporary peace, for applying the principle to war-ships; but the plan was rejected, as such a means of propelling ships was considered to be impracticable. In reference to Fulton's claim to be the original inventor of steam propulsion, Mr. Fairbairn said, that Fulton had most probably seen an account of Symington's experi-

ments; but there could be no doubt that he had the precedence in bringing out steamboats in 1807, and afterwards more successfully in 1810, when his steamboat was at work on the Hudson.

SCREW STEAMING.

A LETTER from Southampton, dated June 16, describes the recent Improvements in Screw Steaming:—

The system of screw compulsion has latterly made rapid progress. The most sceptical among professional men are now becoming convinced of the great merits of the screw for ocean steaming, in preference to the paddle-wheel. Formerly, the whole of the extensive steam operations of the Peninsular and Oriental Company were conducted exclusively by vessels on the paddle-wheel principle. Subsequently, the Directors were induced to apply the screw as a motive power in ships of moderate tonnage; the results being satisfactory, as instanced by the performances of the *Madras, Bombay, Formosa, Chusan,* and some other vessels, an inducement to a further extension of the principle was afforded, and the *Bengal* was built, a ship of 2250 tons, with machinery of 470-horse power. The success of this vessel has been so extraordinary that the company has now announced its determination gradually to discard the paddle-wheel in the whole of its extensive service. The existing vessels on the old-fashioned principle are to be allowed to wear out, while all the new fleet now building for this company, including the gigantic steamer *Himalaya,* of 3500 tons; the *Simla,* of 2600 tons; the *Candia,* 2200 tons; the *Colombo,* 1900 tons; the *Para,* 2200 tons; the *Nubia,* 2200 tons, and others, are to be fitted with the screw. It is even in contemplation to convert some of the existing paddle-steamers into screws, and the *Haddington,* a ship of 1600 tons, requiring immediate repairs, is, we are informed, to be operated upon in this way. This determination having been arrived at, it is now the object of this company to discover the most economical method of applying the system, and to ascertain the precise merits of the diversified varieties of screws now pressed forward upon their attention by inventors and scientific men. An experiment of an important character has been made. The *Cadiz,* a new iron steamer, of beautiful model, built by Messrs. Todd and MacGregor, of Greenock, of 950 tons and 220 nominal horse power, has been taken out on an experimental trip to test the results to be obtained from Griffith's patent screw propeller, now fitted for the first time to one of the company's ships. A few days since the *Cadiz* was tried with six runs, propelled by the ordinary screw, the result of which was an average speed ot 10·20 knots. The mean speed of the two last trials being, with pitch of the screw at 11 feet, 11·54, an improvement of about a quarter of a knot per hour in favour of Griffith's patent had been effected. The superiority of this screw consists in the lessened vibration of the ship when under steam, and the facility with which it can be feathered and the pitch altered to accommodate the vessel when under canvas.—*Times.*

NEW PROPELLERS.

It is averred that the Screw Propeller is still in its infancy, and that its advantages over the old paddle-wheel are, as yet, only partially developed. That such is the case seems to be evidenced by the number of new Screws that are continually being brought before the notice of the public, each involving some separate scientific principle as a claim for improvement. Griffith's Propellers, originally, were three-bladed screws; but as the rule of the service is to have all screws so constructed or fitted, that they can be raised to the deck through a well, or shaft, cut expressly for that purpose, and through which only a two-bladed screw, with the blades in a vertical position, can pass, a doubt existed as to whether the same results could be achieved with a propeller of two blades as were realized with that of three. The results of trials are reported as follow:—with the pitch of the screw at 8 feet 6 inches, 12·242 knots per hour; 10 feet pitch, 11·742 knots; and with 12 feet pitch, 11·092 knots.

The Spiral Propeller, invented by Mr. Maxwell Scott, of Tranmere Foundry, is said to have effected a saving of fuel to the amount of 16 per cent. This propeller is formed on the principle of obtaining as much propelling surface on the outer edge of the blade as possible; at the same time allowing the greatest liberty near the centre, so as to offer the least resistance in the passage of the screw through the water. The propeller has two blades, something resembling the blades of the old-fashioned screw, with a piece cut out of each; thus giving them the shape of an elbow, being diametrically opposed to Griffith's, where the outer edge has the least surface.

Several trials have been made with Sir Thomas Mitchell's Boomerang Propeller, which has been described in the *Year Book of Facts*, 1853. The general result of these trials, according to the report in the *Mechanics' Magazine*, No. 1561, seems to establish the claims of this propeller to public favour. "In point of celerity, Sir Thomas Mitchell has proved the efficiency of his boomerang in a very heavy vessel. In other points, not so striking to superficial observers, perhaps, as celerity, but not less intrinsically important, namely, the diminished wear and tear of ships and the economy of fuel, the superiority of the boomerang is decided." In a trial in the *Conflict*, in the midships of the vessel and below, while the *Conflict* was making nearly 10 knots, no vibration could be perceived. The enterprising merchants of Liverpool have shown themselves sensible of the economical advantages of the boomerang, and have already fitted it to several of their ships, which have accomplished quick voyages with a much diminished expenditure, as already noticed. The propeller used on board the *Conflict* was manufactured by Taylor and Co., of Birkenhead; and Sir Thomas Mitchell pronounced an emphatic eulogium on the skill of their workmen, and their early appreciation of the principle of his invention, or rather his ingenious application of the principle of the rude Australian weapon to the purposes of propulsion. The leading and the following blades of the boomerang propeller may be likened to the dorsal and caudal fins of fishes when swimming, act on water at similar angles, and are rooted on the shaft on the same principle

of strength as those fins are attached to the fish's body, imparting the power which is to give it motion. To give the boomerang propeller full space to develop its powers, larger apertures are requisite than are now generally found in either ships of the royal navy or in merchant vessels. The full boomerang propeller requires, we are informed, a space in length equal to one-third of the height. This alteration can, however, be easily effected.

The average result of this trial was, in six runs, 9·378 knots—an improvement of about two-thirds of a knot on the speed attainable with the *Conflict's* own propeller. The average revolutions were 65½. This trial with the boomerang was made in order to test the action of the blades, after the two small continuations which Sir Thomas Mitchell had been induced to make had been taken off, and the propeller reduced to its original shape and proportions. The result has been a gain of two-thirds of a knot, which nautical men consider a great deal with so heavy a ship as the *Conflict*.

OCEAN STEAMERS.

MR. A. HENDERSON has communicated to the Institution of Civil Engineers a paper on "Ocean Steamers," wherein he made some calculations respecting the comparative bulk of the most famous vessels of antiquity and of our own times. Thus, a ship constructed by Ptolemus Philopater was 420 feet long, 56 broad, and 72 high from the keel to the prow, and it was manned by 4000 rowers, 400 servants, and 2820 marines. It was estimated, therefore, that this vessel had a tonnage of 6445 tons, builder's measurement, and an external bulk of 830,700 cubic feet. Noah's ark would have a tonnage of 11,905, and a bulk of 1,580,000 cubic feet. With these were contrasted the *Great Western*, 1242 tons, 161,100 cubic feet; *Great Britain*, 3445 tons, 416,570 cubic feet; *Arctic* (American packet), 2745 tons, 356,333 cubic feet; *Himalaya*, 3528 tons, 457,332 cubic feet; and calculating by the same rules, taking the dimensions given in the prospectus of the Eastern Steam Navigation Company, their proposed iron ship, 22,942 tons, 2,973,593 cubic feet; or, just double the size of Noah's ark. It was, however, stated that this vessel was intended to be 10,000 tons register, which might be correct if it was built on the cellular system, and was measured internally by the present law. In the course of the discussion the effect of heavy seas upon vessels of 400 to 600 feet long was considered. The waves of the Atlantic were stated by some captains of American "liners" to attain an elevation of about 20 feet, with a length of 160 feet, and a velocity of 25 to 30 miles per hour. Dr. Scoresby, in his paper on "Atlantic Waves," gave about the same mean elevation for the waves in rather a hard gale a-head. On one occasion, with a hard gale and heavy squalls, some few waves attained a height of 43 feet, with a length of nearly 600 feet, and a velocity exceeding 30 miles an hour. Other authorities assumed even more than those heights and distances. The amount of strength to resist the impact of such waves must vary with the length and size of a ship, and the materials of which it was constructed; and as the experience of the Britannia Bridge showed that a weight of 460 tons, at a velocity of 30 miles

per hour, could be borne by a cellular tube of 460 feet span, it was demonstrated, that by the use of iron any amount of strength could be given to a vessel; and as stability could be imparted by proper proportions, efficient vessels could be built of any dimensions, as had been exemplified by the *Great Britain*, which, after remaining ashore on rocks for several months, had been got off without serious injury. There were, however, objections to the use of iron alone for vessels; therefore many other systems had been essayed, such as all English oak, pine of large scantling, three thicknesses of diagonal planking, and iron framing with stout planking; this last combination, with the addition of fore and aft ties and watertight bulkheads, was advocated for efficiency and economy. The proportions of about six breadths for the length were insisted upon, and it was noticed that these were given as the dimensions of Noah's ark, as recorded in Holy Writ. The proper proportion of length to breadth for an efficient ocean steamer was, however, an intricate question. Taking the *Wave Queen* as an example, the length of that vessel had been stated to be thirteen times her beam. Now, such proportions might answer well for the River Thames, and a great speed might be attained; but such a vessel would, under certain circumstances, be unfit to navigate the British Channel. The same might be said of the American river-steamers, which were reported to have attained almost fabulous rates of velocity; but such proportions as theirs, if attempted in ocean steamers, would only induce failure and loss of the vessels in heavy gales in the open ocean.

In the discussion upon this paper, it was stated that the advantages of employing a smaller number of large ships, rather than a greater number of small ships, for a given trade, especially for long voyages, was beginning to be generally admitted by shipowners. A return was published in the *Liverpool Albion* of November 21st, which presented the results of that experience in a remarkable form. "The following table shows the average number of days occupied on the passage by the vessels of different tonnage, ranging from 200 tons upwards, despatched from Liverpool to Australia, in the years 1852 and 1853:

	1852.	1853.
	Average number of days.	Average number of days.
Under 200 tons	137	133
From 200 to 300 tons. .	122	122
,, 300 to 400 ,, . .	123	113
,, 400 to 500 ,, . .	118	112
,, 500 to 600 ,, . .	113	112
,, 600 to 700 ,, . .	107	103
,, 700 to 800 ,, . .	108	101
,, 800 to 900 ,, . .	103	100
,, 900 to 1000 ,, . .	102	95
,, 1000 to 1200 ,, . .	98	91
,, 1200 and upwards. .	91	90

From the above table it will be seen, that in almost every instance the average is in favour of the largest ships, the 600-ton ships having an advantage of 24 days, on the average in 1852, over the 200-ton ships, and the 1200-ton ships having an advantage of 22 days over the 600-ton ships. In 1853, also, it will be seen that the results are much the same." But even with this evidence, it would not be wise to rush to the conclusion that vessels of enormous size would be applicable in all circumstances; in fact, that which determined the expediency of using a large ship was the coincidence of a great amount of traffic and great length of voyage. For example, it might be questioned, except for some special branches of commerce, which appeared now about to be greatly developed, whether a very large ship would be likely to be commercially beneficial between any two ports of Great Britain. As to the mechanical strength of such vessels, there was no difference of opinion on that point among engineers, provided the structure was of iron. Ships of wood, on the contrary, were limited in size by the nature of the material, which was grown, and not manufactured, and therefore the produce was of limited size; whereas plates of iron could, on the other hand, be rolled of any required dimensions. Further, as to the resistance of large vessels to waves, it was evident that the waves of the Atlantic being of the same size whether the vessel was small or large, their proportional magnitude would be decreased as the size of the vessel was increased, so that the large ship, in a gale, would merely encounter waves of the same proportional size as a ship of half the dimensions in half a gale; and it should be remarked, that the largest ships which had been proposed were only double the lineal dimensions of existing vessels. As to the impact of waves upon ships, it should be remembered that a vessel riding on a wave became, virtually, a part of that wave, and moved along with it, as the mass of water displaced by its bulk had previously moved. The large Atlantic waves observed by Dr. Scoresby did not strike the ship, but made her rise and fall in a gentle oscillation, each of which lasted sixteen seconds, a period of too long duration to admit of any approximation to violent collision between bodies. It was only the small wind waves or crests which moved at a different velocity from that of the ship; and the proposed vessels were so much higher out of the water than the observed altitude of these waves, that the decks would probably never be more than wetted by the spray.—*Proceedings of the Institution of Civil Engineers.*

SPEED OF OCEAN STEAMERS.—MEASUREMENT OF SHIPS.

MR. A. HENDERSON has communicated to the Institution of Civil Engineers a paper on the "Speed and other Properties of Ocean Steamers, and on the Measurement of Ships for Tonnage," by Mr. A. Henderson. After alluding to a paper brought before the Institution in 1847, by the same author, in which the fallacy of using registered tonnage and nominal horse-power as the index of the capabilities or speed of steamers was shown, by a comparison of their relative proportions and elements of resistance with the steam-power employed, the present paper referred to a tabular form, con-

taining copious details of dimensions and of general information as to the form, proportions, and speed realized by ocean steamers, compiled from documents emanating from the department of the Surveyor of the Navy, and from returns made to Parliament by the Post Office and Admiralty; showing that, between the years 1845 and 1851, on an aggregate mail service of 1,271,000 miles, the speed realized only averaged 7·945 knots per hour, which was far short of the speed generally supposed to be maintained by mail steamers; the highest speed being 8½ knots per hour, between Marseilles and Alexandria, by H.M. mail packets, and the lowest 7¼ knots per hour, between Ceylon and China, by contract steamers. Reference was then made to a tabular statement, published by the Committee on Steam Communication with India, showing the station of each steamer, including six packets of the Indian navy, running upwards of 325,000 miles, at a speed of 8·082 knots per hour, and eleven contract steamers of the Peninsular and Oriental Company, running above 533,720 miles, and averaging 7·972 knots per hour. By the same table, the speed of the iron steamer *Pekin* was shown to be 7·733 knots per hour; the older timber steamers, *Lady Mary Wood* and *Braganza*, realizing only 7·378 knots and 7·249 knots per hour respectively. Some observations were offered on the various proportions, forms, and resistance of ocean steamers, and the difficulty of obtaining a fair criterion of relative efficiency; with suggestions, that the information might be obtained by recording the particulars required in the columns of a table, similar to one which was exhibited, from which it appeared that the proportions of vessels varied from five and a quarter to eight times their breadth to their length. That the length of the five steamers realizing 8½ knots per hour, averaged less than six times their breadth, while that of those which realized less than 7½ knots averaged upwards of seven and a half times their breadth.

The second part of the paper was on the "Measurement of Ships." It was contended, that the present register of particulars, by omitting the depth, gave less information than the old register; that calculations of tonnage deduced from internal measurement must show discrepancies of 10 or even 15 per cent. between the computed tonnage of timber and of iron ships, of the same size or external bulk; therefore it had become necessary to introduce a method of computation, deduced from both internal and external measurement, so as to combine the capacity for stowage, and the weight or the load, and the displacement.—*Proceedings of the Institution of Civil Engineers.*

NEW DESCRIPTION OF STEAMER.

A NEW description of steamer, called "The Rotatory," now plies on the Clyde, between Glasgow and Dumbarton. The peculiarity of her construction lies in her compactness, her paddles being much lower than the bulwarks; and as her engine is on the rotatory principle, it likewise occupies very little space. The inventor, Mr. David Napier, thus describes her: "The advantages these engines have over others are, that they are more compact, consume about one-fourth less fuel, and require no engineer the steersman, by a peculiar

valve, moves the vessel ahead or astern, without communicating with any one. The furnace-bars contain water, consequently the hot ashes, which are destructive to the common furnace-bar, in this case tend to the production of steam. There is also a simple application of the fan to assist combustion. Such steamers would be invaluable on crowded rivers like the Thames or Clyde, as running down could scarcely ever happen ; the steersman standing before the funnel, and there being no paddle-boxes to interrupt his view, he sees every object ahead, and can stop or reverse the engines in an instant, without leaving the wheel, or applying to any second party."—*Glasgow Courier.*

FLATS AND STEAMERS ON THE GANGES.

THE shells of these vessels are of iron plate; in length they are about 120 feet, with 15 feet beam, and depth of hold about 6 feet. They are sharp at both ends, with a good run abaft, and steer with a very broad rudder, like the rudders of our barges on the Thames. They are flat-bottomed. Beams are placed over the shell for the lower deck, and stout wooden stanchions are fixed upright all round the vessel. Over these, beams are placed for the upper deck. The sides, instead of being planked, are formed of Venetian windows, one in each cabin, and two in the dining-cabin, which is in the centre of the vessel, and extends from side to side. There are glass windows, which can be put in when required. They are always in use during the wet and cold seasons, so that the cabins are then made as warm as if the sides were planked. The Flats are steered forward by a wheel, the tiller ropes being led along the sides on the upper deck. On the same deck are placed cow-house, hen-coops, cook-house, &c. Finally, each flat has three slight masts fixed in a trunk, to lower down when required, and carries lug-sails. The Steamers are constructed on nearly the same plan; and these flats and steamers are, in my opinion, very comfortable vessels, well adapted to the purpose for which they are built.—*Globe.*

A MINIATURE OCEAN STEAMER.

A SMALL Screw Steamer has been built of iron by Mr. Laird, of Birkenhead, for the Maule River, South America. The vessel is named the *Fosforo;* her register is 43 tons, and 40-horse power (engine by Mr. E. Humphries); depth of hold 6 feet, length over all 105 feet. She left Liverpool on July the 17th, when she was loaded to a foot and a half of the water's edge. She was rigged as a three-masted schooner, and had no keel. The ship's company consisted of commander, two mates, two engineers, two firemen, and six men. The *Fosforo* arrived at Valparaiso on the 15th of November, having touched at Madeira, Rio Janeiro, and Montevideo, for the purpose of watering. The total consumption of coals, of various kinds, was 160 tons, equal to 138 tons of Welsh coal. The passage occupied 121 days, 46 of which were under steam and sail, and 28 days under sail alone; having averaged 6 knots an hour all the way out. The remainder of the time was consumed at the various ports touched at, in coaling, and repairing some trifling accidents to the

machinery, and at anchor through stress of weather in the Straits of Magellan. The *Fosforo* is the smallest steamer that ever performed so long a voyage.—*Liverpool Chronicle.*

THE GOODWIN SANDS REFUGE.

A SCHEME for getting rid of the perils of the Goodwin Sands has been proposed by Mr. Smith, an engineer, and has attracted notice. First, it is intended to form a framed breakwater which shall protect vessels in the Downs, when the wind is in such a direction that they cannot be protected by the mainland or by the sands. This structure is of a peculiar character, adapted to the requirements of the situation. Anything in the nature of a fixed edifice cannot be attempted. The chalk formation crops out in the middle of the straits, and a depth of about 100 feet of sand, constantly shifting its position with wind and tide, rests upon it. That the breakwater might be permanent and effective, it must be independent of the sand as a foundation, and be capable of breaking the force of the tremendous seas which set in here when the wind is in certain quarters. It is intended, therefore, to erect the breakwater in deep water in front of the sands, beginning the work near the South Sand Head, so that vessels may reach it with an ample depth of water around, in which case it would become a safe and sheltered anchorage to the Channel and the Gull Stream for vessels navigating the Downs. The breakwater will consist of a number of independent frames or gratings, each about 50 feet long, and rising from the bed of the sea about 15 feet above high-water mark. Each frame will be secured at the base by a suitable shackle to pile-heads, for which Mitchell's screw-pile is peculiarly adapted. This eminently simple and ingenious instrument can easily be bored into sand or chalk, and having an expanded plate with a cutting edge upon it, forms with ease and certainty a fixed point of attachment under water. The frame being upright in the water in its normal position, is restrained in its revolution about its base by jointed stays and holdfasts fastened under water in a similar manner, but kept out of the straight line by heavy weights suspended at the joints. Thus, upon a heavy sea striking a frame, the frame yields to the impact, and the concussion expends itself in straightening the holdfasts. Immediately afterwards the frame returns to its original position by the action of two concurrent forces—the pressure of the water and the weights upon the stays. Over the line of frames, which is to be 2000 feet in length, will be a roadway supported on independent piling; and a tower, with a lighthouse and asylum for mariners, also constructed on the above recoil principle, are embraced in the plan.—*Britannia.*

ZINC SHIP.

A ZINC sloop, the first vessel of that metal in Europe, has been built at Nantes; she draws but little water, and is called the *Compt Lehon,* after one of the directors of the Vieille Montagne Company. Iron is used to a certain extent in the construction of this vessel, and the deck and upper works are of wood.

NEW AUSTRALIAN STEAM-SHIP.

THE *Crœsus*, the first of a new line of steamers to go direct from Southampton to Port Phillip, without touching at any intermediate port, has been built for the General Screw Steam Company. This noble ship, the largest merchant steam-ship which ever left the Thames, is of 2500 tons burden, and was built by Mare & Co., of Blackwall. She is of iron, in water-tight compartments, the dimensions being as follow:—Length between perpendiculars 280 feet, length over all 300 feet, breadth 43 feet, depth 31½ feet. She is full bark-rigged, with an immense spread of canvas, sufficient to force the ship through the water (irrespective of steam-power), with a strong breeze, at the rate of 13 or 14 knots. The *Crœsus* is propelled by the auxiliary screw, and her engines, by Messrs. Rennie, are of 400-horse power, on the direct-acting horizontal principle, having an immediate connexion with the shaft of the screw. The screw itself is a two-bladed one of 16½ feet diameter, with a 23½-feet pitch, and weighs 5 tons. By an ingeniously-contrived hoisting apparatus it can be disconnected and lifted bodily out of the water, so that when the vessel is under canvas alone (which will frequently be the case) no obstruction will be offered to the speed which may be obtained from the force of the wind acting upon the sails. The cylinders of the engines have a diameter of 63¼ inches, and the steam is generated in four tubular boilers, which are so arranged that they may be used singly or collectively, according as it may be necessary and prudent to expend or economize fuel. The engines perform about 52 revolutions per minute, with 16 lbs. pressure of steam, and a vacuum of 27 in the condenser. Besides the great space allotted to passengers, the *Crœsus* has a capacity for 1300 or 1400 tons of measurement freight, will carry 1000 tons of coals, possesses stowage room for 300 tons of baggage and stores, with 103 tons of water in tanks, in addition to an apparatus for condensing 700 gallons of water *per diem.*

The great stowage and carrying capacity of the *Crœsus* will enable her to carry sufficient fuel for the whole voyage out, while, in addition to this, 600 tons of coals are to be stowed in the hold to be used for consumption on the homeward voyage. It is likely, therefore, that the *Crœsus* will start from Southampton with sufficient coals on board (supposing she is favoured with moderate weather) to perform a voyage to Australia and back, either way, in 60 days, or under. In three days' and nights' trial at sea, the speed of the *Crœsus* has been tried under every variety of weather. The *maximum* speed under canvas, with a strong breeze, and the screw disconnected, was 13 to 14 knots. Close hauled, with double-reefed topsails, courses, trysail, and jib (canvas alone—no steam-power applied), 10½ knots. In smooth water, with no sails, the ship steamed 10½ to 11 knots; and in coming up Channel against a heavy north-east gale, with a rough sea, all yards across, the engines forced the ship through the water at the rate of 4½ to 5½ knots. These trials of speed, under every circumstance, were therefore deemed most satisfactory; the

engines worked admirably, with no symptoms of hot bearings, the boilers giving a full supply of steam at all times.

A STEAMER WITHOUT SCREW OR PADDLE.

A STEAM-VESSEL has been launched from Granton, Edinburgh, demonstrating the practicability of a New Principle of Steam Propulsion, superseding both the screw and the paddle. The vessel is 100 feet long, with engines of 30-horse power. Externally there is nothing to distinguish it from a sailing-vessel, except the presence on each side of the hull of a curved pipe 10 inches in diameter, termed "a nozzle," communicating with a water-tight iron case inside. In the bottom of the vessel are apertures admitting the water into a water-tight case with a horizontal wheel fixed on a crank-shaft attached by piston-rods to the engine; and, on the steam being applied, the water-wheel revolves with velocity, and the water is discharged by the nozzles on each side of the vessel. These form the only propelling power, and the invention is remarkable for its simplicity and effect. These nozzles also are of service in navigating the vessel, which, according to the angle of depression or elevation, turns in any direction, or stops altogether, even with the engines working at full power. Although capacity rather than speed has been studied in the construction of the vessel, it easily attains 11 knots an hour. Economy of fuel, freedom from vibration, light draught, and a high rate of speed are among the advantages of the invention. Messrs. Ruthven, of Edinburgh, are the inventors; and the vessel is the first of the fleet of the Deep Sea Fishing Association of Scotland.

LOWERING SHIPS' BOATS AT SEA.

MR. LACON, in a paper read to the Society of Arts, proposes to Lower a Ship's Boat by means of a long bar or rod of iron, with a barrel at either end, of a sufficient size to carry the requisite length of rope or chain, with a friction pulley and break in the centre. The ropes or chains are connected to the barrels in such a manner that they will support any amount of weight till such time as the boat has reached the water, when they will unship and disconnect by their own weight; by which means he prevents the possibility of the boat being dragged forward or capsized or swamped by the action of the ship. By means of the friction break, he enables one man to regulate the descent of the boat, and by means of the parallel action of the two barrels he insures the boat descending evenly upon the water. To show that the plan thus proposed was not mere theory, diagrams were exhibited of the fittings (drawn to scale) on board two of the South-Eastern and Continental Company's ships, with a certificate of experiments conducted at Folkestone, on the 5th of August, 1853, when a boat was lowered several times during the day, while steaming at the rate of twelve and a half knots, with Mr. Lacon and four men in her.

Captain Henderson fully concurred with Mr. Lacon as to the great advantages which would accrue from the use of the proposed plan of lowering boats. A great objection was, however, the ex-

pense it involved, the cost of the apparatus for lowering being considerably more than that of the boats themselves. This would be a fatal objection to its general use amongst our ships, estimated at about 23,000 in number. After twenty-five years' experience, during which he had lost several boats, he had adopted the plan used in the Pacific by American whalers, where the six men who belong to each boat had to manage the entire work of lowering themselves, and where, after they had seen a whale, every moment was of consequence. Captain Henderson illustrated his meaning by reference to a model. Instead of the ordinary plan of using at each end one block, working between two sheaves, which, if the men did not heave fair, caused the rope to be jammed, he proposed to use two three-fold blocks at each end, hung to the davits, which not only must work free and prevent jamming, but, by giving additional purchase, enable the men in the boat to guide it themselves. He also strongly deprecated the practice of keeping boats covered, which was often customary. It was altogether unnecessary, and the cause of much delay and many accidents.

A conversation then ensued on the subject of Plugs for Boats, arising out of the repeated occasions in which, in case of accident, the plugs have been lost, as was the case in the recent wreck of the *Victoria* steamer. Various suggestions were made for securing them, or for the use of some kind of valve which would allow the water to escape from the inside, but would be closed by the pressure of the water underneath. Several contrivances had been patented for the purpose, all of which were to some extent good, it was stated; but the fact of their being more expensive than the common plugs, kept them from general use. The proper plan was to have the ordinary plugs secured beside the hole, and where that was not done, it was from neglect. A very efficient contrivance had been invented by Captain Claxton, which entirely superseded the plug ; it consisted of a small brass tap fixed in the side of the keel, by which the water escaped from the inside when opened, and when closed it entirely prevented the entrance of the sea. Some remarks were made also on the mode of lashing the oars to the boats, and a strap and buckle was suggested to supply the place of cordage, as being more easily undone in the absence of a knife, in case of accident. Mr. Warren, in answer to a question, said, by Mr. Lacon's plan of lowering, both ends of the boat must go down together ; there could not possibly be any up-ending. It was a simple principle applied every day to the lowering and raising of all sorts of weights ; the descent could be stopped at any moment ; and it afforded absolute certainty of safe and equal lowering, so that the boat should reach the water on an even keel.—*Abridged from the Athenæum*, No. 1324.

NEW LIFE-BOATS.

At the late meeting of the British Association at Hull, Colonel Chesney described the Tubular or Double Life-Boat, invented by Mr. H. F. Richardson: it is formed of two tubes of tinned iron, 40 feet long by two-and-a-half feet in diameter, and tapering at the ends.

An iron framework unites the two tubes, which are divided into water-tight compartments, occupied by air-tight bags; the whole is surrounded by a cork fender. Seats for the rowers and passengers are placed above the framework. Colonel Chesney stated this boat to have undergone several severe experimental trials at Plymouth with great success, and he expressed his conviction that it cannot be upset.—(See the paper in full, printed for Colonel Chesney.)

Mr. R. Roberts next described a Life-Boat of his invention: it consists of an iron shell with a hollow keel, made wide enough to admit the feet of persons sitting in the lower part. The sides of the boat are to be lined with two water-tight compartments, and there is to be a hood at the stern, also containing air-vessels, to assist the boat in righting itself, in case it should be capsized. It is proposed to propel the boat by spiral vane-propellers, to be worked by persons standing on the platform. The advantage which Mr. Roberts claimed for his boat was, that the weight was placed very low, and the buoyant air-vessels above, by which means it would be prevented from capsizing.

A model of another Life-Boat, which is intended to be placed at Spurn Point by the Trinity House, was exhibited by the Mayor of Hull. It is to be constructed of wood, and the buoyant chambers are to be under the seats.

In the discussion that ensued, objections were raised to the double life-boat on account of the weight being placed so high, and the difficulty of working it; whilst Mr. Roberts's boat was objected to as being complicated in its arrangements, and containing no provision for the escape of water when filled. Captain Kater, Captain Calver, and other nautical men, expressed doubts whether any of the life-boats recommended would sufficiently answer the purposes required of them.—*Athenæum*, No. 1353.

To these novelties may be added the following:—

A trial was made at Dover, with Clarkson's Life-Boat, manned by eleven men, the patentee, and a friend. Having put to sea, the men, first securing the plugs, commenced filling her with water by means of a bucket; and when filled the sail was set. The weight of water, however, had not any effect upon the boat; and she maintained her position apparently without sustaining the slightest detriment. The crew then rocked her, and endeavoured by every means to sink her. This was also unavailing, and she still sailed as buoyant as before. On the following day Mr. Clarkson gave some additional experiments with his captain's gig, a smaller boat, but made of similar material, and on the same principle as the life-boat. The boat was pitched off the pier into the sea by several men, but instantaneously righted, and relieved herself of water. Several tests were then tried upon her, and among others she was turned over, keel upwards. This was not effected without difficulty, but she turned into the proper position immediately.

In June, an interesting series of experiments was instituted at Limehouse, with four new Life-Boats, built by Messrs. Forrest, for the Royal National Institution for the Preservation of Life from

Shipwreck, to be stationed at Aldborough, Suffolk; Sennen Cove, Land's End; Barmouth and Cemlyn, on the coast of Wales. The boats are built from designs furnished by Mr. Peake, assistant master shipwright at her Majesty's dockyard, Woolwich, and vary in length from 25 to 32 feet, and are to be pulled double-banked. They are clinch built. In lieu of great breadth of beam, the boats possess stability from straight sides and long flat floors; and on trial, it required a large number of men standing on the gunwale of each boat before it could be brought down on a level with the water. The boats are fitted internally with light decks, laid at the level of the load-water line. In the midships below are cable tiers, and on each side, and for some distance before and abaft, the tier is filled in with cork, in water-tight cases. Eight delivering tubes, of six inches diameter, are carried through the decks of each boat, which are closed by Well's self-acting valves. Above the decks, air-cases extend along the sides up to the level of the thwarts, and in the ends of the boats, air-cases rise to the height of the gunwale; which latter, in conjunction with an iron keel, give what is called the "self-righting" power. The cost is about £5 per foot; so that the expense of a moderately-sized life-boat, with carriage, boat-house, and gear all complete, can hardly be less than £300; to which is to be added the cost of the maintenance of the boat, such as keeping her in repair, and the expenses of a trained crew to manage her, which will at least involve another permanent outlay of about £30 per annum.—*Mechanics' Magazine,* No. 1559.

TUBULAR LIFE-RAFT.

SUCCESSFUL experiments have been made on the Serpentine and the Thames, with an expanding Tubular Life-Raft, the invention of Mr. George Frederick Parratt. It is formed of vulcanized India-rubber tubes, enclosed in canvas cases and nettings, so arranged and lashed to cross-spars, as to form, when extended, an excellent contrivance, not only for floating on the water, but being rowed like a boat, and capable of being conveyed with safety through a surf or heavy sea. The object of the inventor, when he turned his attention to the subject, was to provide an apparatus which, in the case of disasters at sea, could be made quickly available for the saving of human life, which could be easily lowered into the water, and when there, capable of sustaining a great number of persons, without danger of sinking. This end Mr. Parratt's invention seems well calculated to attain. He proposes that on board ship the raft should be so constructed as to occupy the interior of a long-boat, or of any ordinary boat carried on a ship's davits; that the tubes should be always kept inflated, so as to be ready at a moment's notice; and that it should be either lowered in the boat or extended to its largest dimensions on deck, by lashing a spar across the longitudinal spars (the work of two minutes), and then dropped into the water without the use of any machinery whatever. All danger of swamping is avoided by the buoyancy of the material; and such is the nature of its construction, that, even should the raft capsize, it would still offer

a large surface on which shipwrecked persons might rest with safety. The capabilities of the raft have been tried in a variety of ways, and successfully so, though, of course, the circumstance of the experiments being made on the calm surface of the Serpentine, and not in a storm at sea, must, as in all similar cases, be fully considered. In order to test the strength of the tubes used, and to prove how easily one of these life-boats or rafts might be launched, a "Tubular Collapsing Boat," invented by Mr. Parratt, was carried upon the bridge over the Serpentine, and thence thrown into the water below. It sustained not the slightest injury, and, though it fell keel up, so to speak, it nevertheless presented, as it floated away, sufficient breadth to hold a large number of persons. This collapsing boat consists of tubes lashed round a framework of a boat-like shape, with three "thwarts," which shut up like a purse. The bottom is formed of nettings to enable the water to have a free course, and the thwarts are kept expanded by means of what are called movable fishes.

SICARD'S DIVING APPARATUS.

EXPERIMENTS have been made in the Seine, of a Diving Apparatus invented by a M. Simon Sicard. In a second trial, M. Victor de Grandchamp, a friend of the inventor, was let down into the river at 23 minutes after 1 o'clock, seated on an iron chair, at a part of the river near the Ile des Cygnes, where the water is not less than 15 feet deep. On reaching the bottom, M. de Grandchamp quitted the chair, commenced his subaqueous promenade, and again came up at 48 minutes after 1, thus making 25 minutes that the experiment lasted. The apparatus is very simple. It consists principally of a metal box, which the diver carries on his back like a knapsack, and in which is produced an artificial atmosphere, which remains the secret of the inventor. To this box there are two openings, corresponding to a kind of helmet, which forms the head-dress, and which terminates at the back by two tubes in caoutchouc about 20 centimetres long; these tubes conduct the artificial air contained in the box to the interior of the helmet. The dress is in caoutchouc, and reaches from the shoulders to the feet. The extremities of the arms have the form of gloves, in order to give free action to the fingers, and the legs are terminated by socks. This dress opens on the breast, and is arranged in such a manner that it can be closed hermetically enough to entirely exclude water. The part over the chest is strengthened on the inside by a kind of cuirass, in order that the pressure of the water may not prevent free respiration. The helmet is of a round form, and large enough to admit of the head moving about in every way. It is furnished in front with three round glasses, one in the middle opposite the eyes, and the others on the sides. To the waist-belt of the dress are adapted several leaden weights, heavy enough to act as an equilibrium to the water. The socks are composed of leaden sandals, fixed to the legs by means of straps. The system is completed by a lantern which burns under water. Three times during the experiment, which was attended with the most complete success, M. Grandchamp came to the sur-

face, bringing with him stones from 20lbs. to 30lbs. weight, without requiring any fresh supply of air beyond that at first contained in the box.—*Mechanics' Magazine*, No. 1551.

THE MECHANICAL NAUTILUS.

THIS machine, resembling that above described, has been experimented with at the Navy Yard, New York. It has the power of ascent and descent at will, entirely independent of suspension. In connexion with the machine at the surface, is a reservoir of condensed air, which, according to depth of water, may contain from 20 to 120 pounds pressure of air to the square inch. This compression is produced by a powerful pump, capable of throwing 4000 cubic feet of air per hour. By an interior arrangement of tanks, &c., a variable buoyancy may be given to the machine, capable of lifting weights of ten or more tons; it can be held in suspension at any point of ascent or descent, thus allowing stones to be raised clear from the bottom, then transported and deposited in any precise spot; movement being effected in any direction whatever, by a series of three cables and anchors worked from the inside, ascent and descent are effected in a most rapid manner. An arrangement of the machine permits the digging of trenches under water, by which telegraph wires and water pipes may be placed below the reach of anchors. Foundations of piers may be prepared, and then built upon, obviating all crane work for raising and lowering stone, as all work of lifting, transporting, and depositing, is done by the machine itself. An arrangement is also made for attaching camels to sunken ships, for raising them, by applying points of support directly to the timbers of the ship. In a word, the power of condensed air acting as a motor, does the whole work, merely requiring two men inside and one at the surface to manage it. Mr. Lee, engineer, entered with his men, and immediately commenced the deseent, depth of water 30 feet. He rose the first time in four seconds from the bottom. The machine, capable of holding ten persons, was moved with one hand by Mr. Clitz, who descended with a party of gentlemen, removing the cover (four feet in diameter) from the bottom. Owing to descent into the mud, the machine was started rapidly to the surface, jumping nearly clear of it, and immediately disappearing. After remaining half an hour longer, the gentlemen reappeared. The success of the machine was perfect. Its dimensions are, 11 feet greatest diameter in the centre, and 8 feet at top and hottom; height, 8 feet; opening in bottom to work through, 4 feet. The descent is attained by moving a single valve, ascent by movement of one air and one water valve. The safety of this machine is great, as, cutting off the air-pipe, ascent can be obtained by six different modes in one minute.—*Abridged from the New York Tribune.*

UNIFORM WEIGHTS, MEASURES, AND MONEYS.

PROFESSOR JACK, of King's College, New Brunswick, has read to the Society of Arts the results of his investigation of the above subject. After a sketch of the history of the Weights and Measures

used in different countries generally, but more especially in England, the author pointed out the arbitrary and uncertain nature of the original standards; and gave a history of the attempts to fix standards of weights and measures from 1742 down to the destruction of the standards themselves by the burning of the Houses of Parliament, in 1834. He then adverted to the proposed methods of restoration, describing the steps taken in France and England to obtain fixed and unchangeable standards, and to a consideration of what are the chief desiderata in a good system of weights and measures. "It is highly desirable," he observed, "that simple, rapid, and uniform methods of calculation be obtained; and that their results be capable of being exhibited with clearness and precision. For these purposes, it is admitted on all hands, that the Decimal Scale is preferable to every other, inasmuch as it would reduce all our numerical computations to the operations comprehended in the first four common rules of arithmetic. Under such a system of weights and measures, therefore, a child would be able to learn everything necessary for entering upon the ordinary concerns of the world in one month, as well as, if not better than, he could in twelve under the complicated and puzzling system we are burdened with at present. In the second place, the primary units of an existing metrical system, more especially those used in the ordinary transactions of trade and commerce, ought on no account to be altered; and even in the multiples and subdivisions of these units no changes ought to be attempted but such as, when assisted by a general sense of their manifest advantages, the authority of the government could enforce the adoption of." Taking these as principles, Professor Jack entered into an elaborate review of the whole subject, pointing out numberless inconveniences resulting from the existing no-system, and suggesting remedies.

MOTIVE POWER.

MR. JUAN DURAN, of Madrid, has patented certain means of Obtaining and Applying Motive Power, his object being to obtain Perpetual Motion, and the application thereof to machinery; and he certainly displays great ingenuity in the construction of the details of his apparatus, the *general principles* of which may be seen from the following description, which we intend to include only the principal features of the invention. A large wheel has a number of small ones fixed on centres around its outer part, the planes of the small wheels being parallel to that of the large one. These smaller wheels have each a weight placed at one part of their circumference, which weight revolves with the wheel to which it is attached. The small wheels are also furnished with cogs round their circumferences. A short cogged surface is likewise placed below the great wheel, and a similar one at its upper part; the cogs or teeth of these surfaces are made to take successively into those of every small wheel that is brought to them by the revolution of the large wheel, and so to give a rotary motion to each small wheel in order. Before the machine is started, the small wheels are so arranged

that all the weights attached to them are without the great wheel on one side, and within it on the other, in consequence of which the said great wheel not being balanced about its centre, will begin to revolve; and as each small wheel, after descending to, moves along the lower cogged surface, the weight attached to it is turned up to the inner part of the great wheel, and ascends in that position; while, on the other hand, as each small wheel, after ascending to, moves along the upper cogged surface, the weight attached to it is turned to the outer part of the great wheel, and descends in that position. By this arrangement it is expected that the large wheel will be kept unbalanced about its axis, and a perpetual motion of it preserved.—*Mechanics' Magazine*, No. 1577.

NEW MULTIPLYING MOTION.

MESSRS. CALLAN and RIPLEY have patented a New Multiplying Motion. Their invention consists of a circular grooved disc and a double crank. The grooves which are formed in the face of the disc are varied according to the multiple required. The crank-pins are mounted with friction wheels, and as the disc rotates these wheels roll along the grooves and thus give a multiplied motion to the cranks. Mr. W. Bull, to whom the invention was submitted, reports that, "The crank-pins describe equal spaces in equal units of time, therefore the power and speed transmitted are perfectly uniform at every point in the rotation. From the fewness and simplicity of the parts, the loss in friction as compared with that of cog-wheels, is reduced about 6-horse power in every hundred. The space required by this motion is much less than by spur-gearing, while the cost is only about one-sixth. This motion saves power by diminished friction, produces no noise, and is not liable to accident." Independent of the danger, and power lost, by the use of cog-wheels, the noise arising from their use has always been objectionable, especially when applied to the screw propellers of steam vessels: in all these cases the application of this invention, if it bear out the statement made, will be of great value; as it will be, also, to the screw ships of the Navy, where, from the small space required, this motion can be easily fitted below the water-line and clear of shotway.—*Builder*, No. 533.

MECHANICAL PROPERTIES OF METALS.

MR. FAIRBAIRN has presented to the British Association a Report of Experiments undertaken at the request of the Society, "On the Mechanical Properties of Metals as derived from repeated Meltings, exhibiting the maximum point of Strength and the Causes of Deterioration." In making the experiments, one ton of Eglinton hot-blast iron was operated on. The proportions of flux and coke at each re-melting were accurately measured, so as to be alike in each. The iron was run into bars 1 inch square, and the trials were made on lengths of about 4 feet, supported at each end, and the weight applied in the centre gradually, until the bar broke. One bar was reserved at each trial, and the rest of the iron

was re-melted. This succession of re-meltings and trials was repeated seventeen times, when the quantity of iron was so much reduced, that it was not considered desirable to continue the experiments. The results obtained prove that cast-iron increases in strength up to the twelfth melting, and that it then rapidly deteriorates. The commencing breaking weight was 403 lbs., and this went on increasing, until, at the twelfth melting, the breaking weight was 725 lbs. At the thirteenth, it was 671 lbs.; at the fifteenth, 391 lbs.; at the sixteenth, 363lbs.; and at the seventeenth melting the bar broke with 330 lbs. After the fourteenth melting, the molecules of the metal, when fractured, appeared to have undergone a decided change. There was a bright band, like silver, on the edge of the bar, whilst the middle retained the ordinary crystalline fracture; and in the succeeding meltings the metal was bright all over, resembling the fracture of cast steel. Mr. Fairbairn exhibited specimens of the iron broken at each successive melting, and he said it was his intention to have them analyzed, to ascertain the chemical change that had been effected by the repeated processes.

PNEUMATICS OF MINES.

Mr. Joshua Richardson has communicated to the Institution of Civil Engineers a paper in which, after showing and lamenting the discrepancy existing among the various systems of Ventilation, which might be traced to the want of good formulæ for the necessary calculations, he strengthened his position by the evidence given in the Reports of the Parliamentary Committees, and of that at South Shields, in 1843. He then explained the usual modes of calculation, and demonstrated, that many more points required to be considered than were ordinarily admitted to bear on the question, that no sound basis of calculation could be formed on any one of the various elements, but that the whole, must be carefully considered, after having examined each element in detail.

The chemical constitution and properties of atmospheric air were then considered; its uses in the animal economy, its adulteration by deleterious gases, and the compensating action provided by nature for restoring it to its primitive purity.

The principles of combustion were then defined, and calculations were given for determining the amount of atmospheric air required for supporting combustion and animal respiration, and for compensating for the amount of deterioration by respiration. The several quantities of air practically required in mines for the healthful support of men and horses, were carefully shown, with the modes of calculating, allowing for the distance the air must travel.

Then followed the analysis of the deleterious gases existing in mines,—the fire-damp, choke-damp, and after-damp,—with the quantity of atmospheric air required to dilute these vapours, so as to render them innocuous, or to promote such ample ventilation as to sweep them away from the galleries of the mines.

A clear description was then given of the "Eudiometer," and of the method of using it to discover the quantity of oxygen, and

the per-centage of carburetted hydrogen, or other gases, contained in the air of any part of a mine; the solution of chlorine in water, determining the quantity of hydro-carbonate, or fire-damp, present; that of green sulphate of iron, impregnated with nitrous gas, the relative quantity of oxygen; and that of lime water (or better, caustic potassa, or baryta), the relative admixture of carbonic acid.

FURNACE AND STEAM MINE VENTILATION.

AT a late monthly meeting of the North of England Institute of Mining Engineers, the subject of discussion was the relative merits of the Furnace and the Steam-jet in the Ventilation of Coal-Mines. Mr. Nicholas Wood, the President, detailed the results of a series of experiments which he had made, with a view of ascertaining whether the steam-jet was useful as an auxiliary or not; because, up to the point at which the furnace and the steam-jet acted together, or were of equal power, the furnace was unquestionably the most effective and economical of the two. The question was, whether after that the jet was an auxiliary to the furnace or not, and if so, to what extent it was useful or beneficial. He had ascertained, as might have been expected, that when the jet was applied to a current of air moving at a very great velocity, its application as a mechanical power became proportionably less; and when the velocity reached the extreme limit of the furnace, the steam-jet was scarcely able to follow the air; in fact, it rather opposed it, and the air had to drag the steam after it. There could be no doubt that an efficient auxiliary to the furnace was exceedingly desirable in a mining point of view in certain cases. With reference to that point, there was now erecting in South Wales, by Mr. Struvé, a very powerful machine, the piston of which was about twenty feet in diameter, and calculated to pump out about 10,000 cubic feet of air in each stroke. Both Mr. N. Wood and Mr. Stephenson agreed that steam employed in working such a machine was likely to be much more effective than when blown out of a jet. Mr. Stephenson thought the steam-jet a misapplication of force, which had arisen from a mistaken view of the cause of the efficiency of the steam-blast in locomotive engines. If the steam-jet were applied in a tall chimney, it would be of no use whatever; it would not then be in an energetic state, and all its force would be expended on the elasticity of the air in a very few feet.

NOTES ON TIN.

MR. LAYARD, in his work upon Nineveh and Babylon, in reference to the articles of bronze from Assyria, now in the British Museum, states that the Tin used in the composition was probably obtained from Phœnicia; and, consequently, that that used in the Assyrian bronze may actually have been exported nearly three thousand years ago from the British Isles. The Assyrians appear to have made an extensive use of this metal; and the degree of perfection which the making of bronze had then reached, clearly shows that they must have been long experienced in the use of it. It is inferred that they received what they used from the Phœnicians. It is said that the

Phœnicians were indebted to the Tyrian Hercules for their trade in tin; and that this island owed to them its name of *Baratanac*, or Britain, the land of tin.

The Great Polgooth Mine, in Cornwall, has been worked for tin from a period far too remote for the earliest record, and the histories of Cornwall have severally given it that notice to which it was entitled from its magnitude and importance. At least from the time of the requirement of tin by the Phœnicians to the present, it has been wrought, more or less, with short intermissions, and has yielded a greater quantity of ore than any other tin mine in the county ot the same depth. In a geological point of view, it presents some of the most remarkable features known in the science of mining, and has not unfrequently baffled all the known theory and practice of the day; and for this reason mainly—whilst other mines have started into existence at a much more recent period, and have been profitably worked to a great depth, this mine has only yet reached to about one hundred and ten fathoms. The mine, during the last sixty years, has not been sunk one single fathom.

The following improvements in the processes of obtaining tin, have recently been published by Mr. F. W. Emerson, of the Trereiffe Chemical Works, Penzance. The improvements consist in a means of purifying and separating the ore of tin from other metallic oxides, sulphurets, arseniates, tungstates, or other compounds, previously to its introduction into the smelting furnace, by digesting the ore (either with or without the aid of heat) in a mixture of common salt, sulphuric acid, and nitrate of soda or potash; the last of these not being absolutely necessary to the success of the operation, though it helps to shorten the time in which the process is performed. The inventor first makes a correct analysis of a fair sample drawn from the bulk of the ore to be operated upon, in order to ascertain the exact nature and amount of the impurities. In the event of its being found to contain any compound of sulphur or arsenic, he first roasts or calcines the ore by any of the ordinary known methods. This process is not necessary, unless such compounds are present. If it is found to contain oxide of tin—the ores of tin mostly occur as a peroxide—it will be necessary, in order to avoid loss, either first to peroxide it, or afterwards to precipitate it from solution by insertion of metallic zinc, or any other precipitating agent. To peroxidize the oxide of tin, he saturates the bulk of the ore to be operated upon with nitric or nitrous acid, and after allowing it to stand for two or three hours, to permit a full reaction to take place, he puts it into an iron, fire-clay, or other convenient retort, and distils or evaporates it to dryness, receiving the nitric or nitrous acid gases in stoneware or other convenient condensers, to be used over again. He then mixes the ore with such a quantity of common salt as by decomposition with sulphuric acid shall yield a sufficient amount of muriatic acid to combine with the contained impurities of metallic oxides, or bring the oxides of iron and manganese in wolfram, or the lime in tungstate of lime, into a soluble state. He then puts the ore thus mixed with salt into a cistern formed of granite, slate, stoneware, or other material that is not

seriously acted upon by acids (a wooden trough has been found to answer the purpose), and pours upon it such a quantity of either brown acid or oil of vitriol as will effect the decomposition of the salt. The inventor prefers to use an excess of sulphuric acid. He then turns into the mixture a jet of steam from a steam-boiler, so as to keep the said mixture at about 200° Fahr., stirring it about from time to time with a wooden rake or shovel, so as to expose fresh surfaces to the action of the reagents, adding a small quantity, say six or seven pounds to the ton, of nitrate of soda or potash, for the purpose of enlivening and quickening the operation. If the material should contain micacious or magnetic iron ores, it would be advisable to increase the amount of nitrate of soda or potash, to assist their oxidation and conversion. The invention also describes analogous methods of treating the ores when copper or tungstate is contained.—*Journal of the Society of Arts,* No. 50.

ORE MACHINERY.

Mr. C. F. Stansbury has read to the Society of Arts a paper on "Machines for Pulverizing and Reducing Metalliferous Ores." The author first considered the conditions in which gold presented itself in the various localities where it was found. He then proceeded to describe the chief sources of supply in later times. He said that, notwithstanding this extensive distribution of gold, and the great desire of man to become possessed of it, the methods which human invention had up to this time devised for the purpose of obtaining it had been but partially successful. The processes for securing gold might be divided mainly into washing, smelting, and amalgamation. By washing, was meant every process which depended for its efficacy upon the superior specific gravity of the precious metal as compared with the substances with which it was mixed. The process of smelting was not thought to be applicable to the wants of gold-seekers of the present day. That of amalgamation involved, of course, the previous reduction of the ore to a finely-divided state, in which alone the mercury could seize hold upon the gold and secure it; and the great object hitherto had in view had been, to produce machinery capable of bringing the rock to such a state of powder as to allow the mercury to be brought into complete contact with every particle of the precious metal. This had been attempted by means of machinery for crushing, stamping, and grinding. In stamping machinery there was a great loss of power by friction. In the "Mexican Raster," or "Arrastra," of California, the grinding was effected by the dragging, or rubbing, of stone mullers over a bed-stone of hard granite, inclosed by a wooden tub. This process was of course slow, and the friction great. In the old Chilian mill, large and heavy cast-iron wheels moved round in a trough over the ore to be operated upon. A large quantity of quicksilver was placed in the bottom of the trough, and water was supplied at the top. The ore was ground by the double action of rolling and grinding. This mill was the best of all the old contrivances for reducing gold ore, as it pulverized, washed, and amalgamated by one

and the same operation. In Mr. Cochrane's crushing machine the wheels of the Chilian mill were replaced by balls, worked by the pressure of a revolving dome of iron placed above them. The idea, though ingenious, was defective, as the friction between the balls and the dome would be equal to the work done; and as the basins remained horizontal, the ore after being pulverized had to be amalgamated in a separate apparatus. The only process which seemed hitherto to have answered all the conditions necessary to an amalgamating apparatus, was what was called at the diggings the miner's assay—a method employed at the mines for determining the value of ores which it was proposed to work. In this process the mortar and pestle were employed. Mercury was put in the mortar, the ore to be tested was thrown in and covered with hot water, when the operation commenced. The pulverization was perfectly effected by the rolling and grinding, or rubbing action of the spherical end of the pestle; the mercury was kept at the point of crushing in the bottom of the mortar, and was kept heated by the boiling water. Here, then, were all the necessary conditions—perfect pulverization and instant amalgamation by pure and hot mercury. On a large scale, the cost of heating sufficient water to attain this result would, of course, be a practical difficulty. In Mr. Berdan's machine, the principles of the miner's assay were closely followed, while the expensive process of heating water in large quantities was avoided. The novel features of the machine consisted in the arrangement of an inclined revolving basin in connexion with balls of corresponding size and weight, producing a rolling and grinding motion, which it was believed had never heretofore been attained, and in the heating of the mercury, which had never previously been attempted on a large scale. The peculiarities of the invention did not consist in the use of balls and basins, but in —1st. The incline of the shaft on which the basin revolved, which kept the mercury always at the crushing point, and caused the balls to work by gravity; 2nd. The production of a combined rolling and grinding action by the contact of the balls; and, 3rd. The addition of heat to the mercury by means of the furnace below the basin.

Of the working of Berdan's Machine we find the following data in *The Mining Journal* of December 24:—On the 22nd, Mr. Vatcher, of Exeter, attended at the Windsor Iron Works, City-road, to witness the reduction of half a ton of Cornish gossan, obtained from a fine lode six feet wide, on a sett of his own, highly promising for copper. The gossan was divided into two parcels of 5 cwts. from a shallow depth, and 5 cwts. from ten fathoms deeper. The results from the former were not so satisfactory as was anticipated from the character of the gossan, which was highly quartzose and ferruginous, very much like the Poltimore mineral, but lighter in colour. It gave a produce equal to 4 dwts. per ton. That from the shallower level gave far more satisfactory results, averaging a yield of 1 oz. 6 dwts. per ton. The 1000 lbs. were pulverized, amalgamated, and washed, ready for sublimation, in fifty-five minutes. A box of black jack (sulphuret of zinc), from Great Sheba Mine, was put to the test, by Mr. Vatcher, who has also had tested 145 lbs. of copper ore, which pro-

duced at the rate of 1 oz. 1 dwt. per ton; and 32 lbs. of gossan, from the same mine, which gave after the rate of $1\frac{3}{4}$ oz. per ton.

M'FARLANE'S GOLD-WASHER.

THE following method of separating gold from the *débris* and other foreign matters associated with it in its native state, has been communicated to the *Mechanics' Magazine* by Mr. Peter M'Farlane, of Comrie, Perthshire. As it appears to be extremely simple, and eminently adapted for many situations in the auriferous districts of Australia and California, if not as a final, at any rate as a preliminary process, we give the following description of it. It will be seen that in common with other plans for a similar purpose, it proceeds upon the well-known principle, that when small bodies of different specific gravities are thrown into a fluid, the heavier ones descend the most rapidly, and reach the bottom first. In devising this process, the inventor has applied that principle with great ingenuity, and probably it would be attended in practice with great success.

The apparatus consists of a tank fourteen or fifteen deep, and of any convenient width, which is filled with water. By means of small horizontal slits in one pair of opposite sides of the tank, and corresponding grooves in the other, two sheets of iron can be introduced or withdrawn till they rest in the middle on a movable cross-bar. There is a false bottom exactly fitting the tank, which can be let down by means of ropes till it rests upon the true bottom. The movable bottom is perforated like a sieve, so that the water flows freely in either direction through it. It has also low upright sides, capable of sliding down the tank. When this false bottom is lowered into the tank, and the mouth of the vessel shut by pushing in the iron sheets, a layer of the *débris* is spread over the lid or cover which in that position they form, and then the sheets are instantly withdrawn. The *débris* then fall immediately into the water, and their particles sink in the order of gravity to the false bottom. This bottom is then raised, taken out of the tank, and covered with the two sheets that had lately formed the tank-cover. It is then inverted and lifted off the cover, when the gold will be exposed on the now upper surface of the *débris*.—*Mechanics' Magazine*, No. 1561.

SHRAPNEL'S PATENT ORE-CRUSHING MACHINE.

CONSIDERABLE attention has been bestowed upon a series of experiments with Captain Shrapnel's Ore-crushing Apparatus, performed at the foundry of the Messrs. Glover, of 168, Drury-lane, Engineers to the Board of Ordnance. The result of these trials tends to establish the efficiency of the invention for operating on the hardest mineral matters with rapidity and economy, on a large scale of working. For the mechanical reduction of the ordinary auriferous quartz—to which purpose the invention is mainly directed—it seems well adapted; the stone being immediately brought to the state of an almost impalpable powder, containing, however, a few small bits, which, if necessary, can be operated upon anew.

The invention consists of a chamber about ten feet long, eight feet high, and six feet wide, the back of which is made of inch and a half wrought-iron, and sides of sheet-iron. These are united in the ordinary way by punching and rivetting, and the back plate is stiffened externally by diagonal ribs and struts. The whole rests upon a framed timber-bed, which is continued in front for the purpose of receiving an iron rail-track, upon which the gun can traverse. In point of principle, this is nearly all that is essential to the working of the apparatus ; though its perfect application for practical purposes introduces a few details, some of which we shall notice.

The operation of the apparatus may be described as follows :—The gun being charged with powder, and a wad rammed down upon it, a charge of the ore, previously broken into bits sufficiently small for the bore, is rammed down upon the wad, and secured by another. It is now moved forward upon the rails against the front of the chamber, where a circular hole, of a diameter rather larger than that of the muzzle of the piece, is cut to receive it. The muzzle being just introduced within the thickness of the plate, the piece is primed and fired, when the charge is projected against the stout plate at the back of the chamber, with the entire expansive force of the explosion. To relieve the sides of the chamber from the concussion they would sustain by the sudden and forcible injection of expanded air, the roof is formed in doors, which are hinged upon lines parallel to its width. Upon the explosion taking place, these doors are suddenly lifted, and so act as safety-valves, after which they immediately fall. In practice, these doors would be overlaid with chains, or otherwise limited in their motion about their hinges. The gun now recoils upon the rails, one or more of the doors in the roof is opened, and a door in the front wall which contains the perforation for the muzzle. In this state of the chamber it may be entered, if necessary, to remove the *débris*. It would be provided in practice with a false bottom perforated to the minimum size of the broken particles available for the subsequent processes. A drawer underneath this would be withdrawn at convenient intervals, with the ore in a sufficiently minute state of reduction, while the *débris* kept back by the perforated bottom would be collected, and returned into the gun, where they would very conveniently fill up the interstices between the larger pieces, and contribute to improve the result obtained. The final operation of separating is performed by a gentle blast, which winnows the lighter, and allows the heavier metallic particles to fall.

The form of the apparatus as exhibited in operation at Messrs. Glover's though not intended to show more than a rough approximation to the results that would be obtained with a perfect adaptation of parts, and an adjustment of the charges founded upon experience, afforded abundant promise of the practical efficiency of the invention. Masses of Californian quartz were reduced without the slightest difficulty, the entire charge, scarcely with any diminution, being acted upon ; the hardest Aberdeen granite, which we believe has not yet been broken in any of the stamps or ore-crushers, yielding equally with less obdurate materials, and being reduced into

a fine powder, which would require but small preparation to become available at once in an elegant branch of the decorative arts—the imitation of stones by mineral papers. The granite pillars of the hall of Fishmongers'-hall are said to have cost £300 each. They might be produced by this method with equal effect to the eye, at as many sixpences. Iron-stone and copper-ore were similarly reduced; and some specimens of the latter from Cornwall and Wales, which were operated upon, especially elicited the approbation of several mining gentlemen who were present on the occasion.

To economize time, several guns could be mounted upon a turn-table, or there might be more than one pair of rails, and each pair might branch off into two, furnished at their intersection with spring-switches; which latter arrangement, when one gun had recoiled along one branch, would allow another gun upon the other branch to pass through to its position for work.

In the present state of the metallurgical arts, it would be difficult to say to what purpose this process might not be applicable; and it is extremely probable that in our iron and copper districts we shall soon find it play a conspicuous part. As regards the crushing of quartz, it has this decided advantage over those arrangements which depend upon ordinary mechanical action—that no machine can stand the rugged nature of rock-crystal, or silicium.

Its saving in working, independently of all considerations of facility of manipulation, may be set down moderately at 50 per cent.; while the stimulus it will give to mining operations in general, by rendering expensive machinery unnecessary, cannot well be estimated. In the gold colonies, it will prove of great value to miners. Water is, in general, extremely scarce within a convenient distance of the diggings to work the machinery; and to transport ponderous structures across those unprepared and rugged regions, is attended with costs and difficulties of a nature to deter the most enterprising. For a cost of from £300 to £400, an apparatus on Captain Shrapnel's principle can be procured, which possesses the advantages of being small in bulk, easily movable, and always ready for immediate use. Served by two men, it is capable of reducing from thirty to forty tons of quartz per day, without having recourse to water; and there is this collateral advantage—not to be despised in the rude state of society prevalent in the communities of the diggings—that the chamber admits of being converted into a temporary garrison for the defence of the party or company using it.

Captain Shrapnel, the author of the present invention, is the son of the celebrated General Shrapnel, whose name will always live in the history of British military art. By this new resource he may probably contribute as much to the perfection of some of the most important of the arts of peace, as his illustrious father has done to those of war.—*Mechanics' Magazine*, No. 1561.

THE DOWLAIS IRON WORKS.

The following account of the origin and gradual extension of the Dowlais Iron-works, is abridged from an article upon the subject in the *Gentleman's Magazine* for February, 1853.

The mineral lease of Dowlais was granted about the year 1748 by Lord Windsor, and under it was erected the first furnace in South Wales for the reduction of iron ore by means of pit coal. By degrees the Guest family became possessed of a part of the interest of this lease, and, finally, on the death of his father, Mr. Thomas Guest, and of his uncle, by marriage, Mr. Tiatt, in 1815, Mr. John Guest succeeded to nine-sixteenths, and his brother, Mr. Thomas Revell Guest, to one-sixteenth of the whole. Mr. Thomas Guest, who was his only brother, died, childless, on the 30th January, 1837. After having spent a few years at school at Bridgnorth, and afterwards at Monmouth, Mr. John Guest passed through the different departments of the works, mastered the details of each, and the language of the people, and finally acted, under his uncle, as general manager. The concern was then in its infancy. Its produce, which in 1806 had been about 7000 tons of pig iron, was even then only 20,000 tons, from four blast furnaces. The finances also were so embarrassed, that it is said to have been a serious consideration with Sir John whether he should engage in the works, or push his fortune in some other direction. Having decided upon the former course, he speedily raised the number of furnaces to eight, and the annual production to 30,000 or 40,000 tons; and about 1824 there were eleven furnaces, and, by the introduction of new blowing machinery and improved arrangements for the raising and transport of the raw material, the annual production was raised to about from 45,000 to 50,000 tons.

About 1826, Dowlais boasted twelve furnaces, and the largest blowing engine then known. In 1831, Sir John patented a plan for running the melted metal at once from the blast furnace into the refinery, by which means he effected a considerable saving in fuel and in the waste of metal, and rendered his works equal to the annual production of 60,000 tons, thus taking in the trade the lead which he ever afterwards maintained. In 1835, there were fourteen furnaces; and to meet the rising demand for railway bars, and notwithstanding the approaching termination of his lease, he had the spirit, in August, 1840, to augment the furnaces to eighteen; and by the introduction of various improvements (patented) in the manufacture, he raised the power of production to 100,000 tons annually, and actually produced that quantity of raw iron in 1849, when he sent into the market 75,000 tons in the form of bars and rails.

The steam power, which in 1815 was inconsiderable, at this time amounts to 4989-horse power, of which the blowing engines employ 2063, the forges and rolling mills 1380, the coal and ore works 967, brick-making 17, stabling 9, and locomotion 554. As recently as 1814, the ore was carried to the furnaces in sacks and panniers on the backs of mules. In 1849 there were 500 horses employed. The Dowlais Works freight, on an average, a ship a day in the port of Cardiff. Of ore, coal, and limestone, about 740,000 tons are annually raised, besides about 1,171,000 tons of shale and useless matter, raised to be thrown aside. In 1815, Dowlais contained about 1000 to 1200 work-people, residing in 100 cottages. At this time there

are probably 3000 cottages and 15,000 inhabitants, of which about 7000 draw pay direct from the works. The money payments in labour rose in 1845-6-7 to 30,000*l*. per month, or 360,000*l*. per annum—a sum the mere providing of which in coin to meet the weekly demand, was a somewhat weighty financial operation. At one time Sir John Guest possessed a bank at Cardiff. He was also an original promoter of, and a very large shareholder in, the Taff Vale Railway, of which he was for many years the chairman, and always its principal freighter.

Sir John died, as he had ever wished to die, at Dowlais, amidst his own people, and is there buried. His funeral was attended by an immense concourse of about 20,000 persons, most of whom were more or less connected with his works By common consent, all business and work were suspended, and the shops closed in the district.

IMPROVED ROSE ENGINE.

THE Committee of the Franklin Institute have made the following interesting report upon an improved Rose Engine, invented by Mr. P. N. Receveur, of Philadelphia:

That the improvements are numerous and important, and require description in detail, as follows:—

In the engine employed for rose-turning, the following kinds of movement are required:—1. Revolution of the work for oval and circular cutting, with its modifications; or a reciprocating movement for right line or parallel cutting, with its modifications. 2. Lateral motion of the work or tool, to produce the wavy lines of a pattern. 3. End motion of the work towards or from the tool, to change the depth of cut at stated and regular distances. 4. A change (at will) of the connexion between the work and the pattern, so that the angle between the two can be varied at any moment. 5. A feed-motion, to carry the tool in a lateral direction to given distances at stated periods, required in producing a series of parallel or concentric cuttings. 6. A circular motion of the tool on its bed or rest, so as to vary the angle of the cut, required in engraving the edges of watch-cases, &c.

The general form of the machine embodying the foregoing movements, and called the "Rose Engine," may be briefly described as consisting of a hollow mandril, on which are several narrow drums, whose peripheries are scolloped or shaped according to different designs; passing through this mandril is another, solid, revolving in bearings or journals, and carrying in the front end chucks, &c., as in the ordinary lathe, and a cord-wheel at the other end, through which rotating movement is communicated in the usual way. The hollow and solid mandrils may be connected or disengaged at will, by a paul pressed by a spring into notches cut at regular intervals into the circumference of a plate at the back-end of the guide-drums. The tool is attached to a frame, which, in Mr. Receveur's improved engine, is pivoted on the table, and is free to vibrate laterally: its motion in this direction is governed by a point bearing against the guide-drums,

and which being fixed opposite either of these, of course moves the tool in accordance with the pattern cut upon its edge; or when withheld from contact by lightening a spring, the tool describes either a circular, oval, or straight vertical line, as the case may be.

The solid mandril carrying the work is at liberty to move endwise, for the purpose of deepening or lightening the cut, the tool having no such motion; the shaft is pressed against a shoulder by a spring, and is reacted against this spring by a point attached to the tool-frame bearing upon wavy surfaces cut on each alternate guide-drum projecting from the others for the purpose. It is clear that the pattern on such guide-drum will regulate the depth of the cut. The vertical motion for right-line work is produced by an eccentric; and a pentagraph lever movement connected with the same eccentric, enables any given pattern to be reduced in any ratio upon the work, giving rise to endless variety in the designs.

The important points of difference between the old machine and that of Mr. Receveur, are—First, that the tool-frame is in his engine made movable, and the mandril, with the work, rotates in permanent bearings, while in the old machine this condition of things is reversed; so that while in this latter the momentum of the moving parts vibrating is such as to preclude a great rapidity of motion, preserving the necessary uniformity and delicacy of cut, in the engine of Mr. Receveur, by a very simple but ingenious modification, the speed at which work can be done is limited only by the skill of the operator. Secondly, that in the old engine, in order to change the angle between the work and pattern, it is necessary to stop the rotation of the mandril, while the paul before described as connecting the two is released, and after moving the drums to the desired point, again notched; while in Mr. Receveur's engine, a pedal arrangement is introduced, whereby the aforesaid paul is tripped by pressure of the foot; the point on the tool-frame is at the same time advanced, so as to press tightly against the drums, and so keep them from turning, while the operator continues the rotation of the mandril until it has arrived at the desired point, when the paul is again permitted to drop in. It should be observed that this cannot be applied to the old form of engine, on account of the vibrating pedestals supporting the drums, and the fixed tool-frame, &c., which of course renders it impossible to hold the drums while rotation of the mandril is carried on. This again permits of much greater rapidity in the performance of work. Thirdly, in the old engine the weight of parts in the pentagraph-lever arrangement is balanced by a weight suspended by a cord passing over pulleys; while in the new engine, they are connected to a spiral spring, like the main-spring of a watch, placed beneath the table, and so arranged that equilibrium exists at any point in the vertical stroke. As the delicacy of the cut in right-line work would be destroyed by any irregularity of motion, this must be a decided improvement.

Besides these principal points, there are numerous details of minor importance, but all tending to facilitate the execution of designs, which it is impossible to describe in the limits of a paper like this;

and which, though perhaps they are movements already known separately in the arts, are believed to have been first applied by Mr. Receveur to the Rose Engine.

The Committee feel satisfied, after a close examination of Mr. Receveur's improved engine, that the features he has introduced are highly ingenious, and promote in a marked degree the objects desired —viz., rapidity, accuracy, and variety of design; while they are believed to be original, and applied first by him to the purpose.

They therefore recommend that a Scott Legacy Medal and Premium be awarded to him for his invention.

DANIELL'S PATENT STEEL-SHOD STAMP-HEADS.

WE are glad to announce the complete success of this very important invention, especially with reference to the Cornish tin, hitherto seriously deteriorated and rendered unfit for various purposes in the arts, from the presence of iron, derived from the abrasion of the cast-iron stamp-heads now in use; and hence the constant and well-founded complaints on the part of the manufacturers having to use that metal, of the bad colour of the Cornish tin. This will be entirely obviated by the introduction of Daniell and Co.'s Patent Heads; for whilst the principal part of them always remains intact, the steel shoe may be renewed at pleasure. It has been found by recent trials, for two months, at Tincroft Mine, in Cornwall, upon the hardest stones which that or any other mine in this country produces, that whilst the common cast-iron stamp-heads had lost 2 cwts. in weight and upwards of a foot in length, the wear of the cast-steel shoes was barely appreciable; and now it has been ascertained that the most highly-tempered steel may be used with impunity, they may be rendered comparatively everlasting for all moderately hard tin-stuff or other ores. Cast-iron being of equal density with the oxide of tin, it will be seen that in the experiment referred to, from the wear and tear of the common stamp-head, 2 cwts. of cast-iron per head became inseparably mixed with the tin-ore in two months, and sold as such, to the great detriment of the tin trade and manufacturers in general; for as, in the present case, where the trial referred to was made, 60 heads were constantly at work, the surprising quantity of 6 tons of cast-iron will have been smelted with the ore every two months. The first object of the patentees has been to remedy or prevent this evil; and their patent, and the introduction of cast-steel for blasting purposes, now getting into general use, will fully effect it; but there are other obvious advantages connected with this invention, of vast importance to the miner. The tin ore for the most part is only found as an oxide, and the accidental admixture of iron being prevented, there can be no reason why it should not always fetch the price of fine tin. In point of economy the steel shoes have an extraordinary advantage over the iron heads now in use—the shoe only, as before observed, requiring renewal, the other part of the head being simply a make-weight; and a receiver, or socket for the shoe, will not be exposed to wear or accident. By the application of the steel shoe, the effective power of the engine will be greatly increased; for besides

that the very frequent necessity for the stoppage of the machinery, in order to shift the tongues and introduce new heads, will be almost entirely avoided, it will always present a flat surface to the ore operated upon. We need scarcely remark that the cast-iron head soon becomes rounded and misshapen, so that it is often necessary to throw them out at the end of a month's work; added to which, it has been usual, with a view to economize, to continue to work the cast-iron heads till a very considerable part is worn away, to the manifold sacrifice of the power of the engine. This defect will also be obviated by the introduction of the steel shoe.

To the gold mines of Brazil, and other places where the cost of freight and carriage is an object, from the great durability and portability of the shoe this invention must be of the first importance. —*Mining Journal.*

COATING IRON WITH COPPER.—WATTS' AND BURGESS' PATENT.

THIS patent has just been taken out for coating iron nails, bolts, sheets, and tubes, with copper or brass. As this is effected by fusion, none of the injurious consequences that take place when the coating is deposited by electrical agency can occur. A long series of trials have been conducted at Woolwich Dock-yard, in which iron bolts and deck nails, coated with copper throughout their length, and having solid copper points fused to one or both ends, have been experimented upon. The copper ends are made sufficiently long to clench. These tipped or compound bolts are quite a novelty in ship-building, and possess all the advantages of solid copper bolts.

The experiments in Woolwich Yard, under the direction of Mr. Charles Atherton, chief engineer, commenced with trials to ascertain whether the coating process acted injuriously upon the iron. Bars of iron of various sizes were cut into equal lengths, and a certain number of each size were then coated. These were tested in the hydraulic machine with an equal number of the uncoated lengths; no difference in their strengths could be perceived. Other lengths were subjected to cold hammering, being bent double and beaten close, but the texture of the iron was not at all injured. Iron bolts with a solid end of copper were then turned to exactly an inch in diameter, and placed in the proving-machine; in all cases the fracture took place in the solid copper, and not at the juncture of the two metals, which it was afterwards found impossible to sever with a strain equal to 21·6 tons to a square inch.

Deck nails were then driven into deal and African oak without injuring the heads, although in some instances no hole was bored to receive them. Two logs of African oak were bolted together with the pointed bolts, which were afterwards clenched in the usual way; the logs were then wedged asunder, the heads drawing through the solid wood. This experiment was repeated, a copper bolt being substituted for one of the compound bolts; when the logs were set apart the copper bolt drew through the rings, the other standing firm. The trials were pronounced highly satisfactory by the officers appointed to superintend them.—*Mechanics' Magazine,* No. 1563.

COATING IRON WITH ZINC AND OTHER METALS.

MESSRS. GRESSEL and REDWOOD, of London, have patented the following methods of Coating Iron with Zinc and other Metals.

To Coat Iron with Zinc.—The Zinc is melted in an open vessel, and on its surface is placed a layer of the chloride of zinc, or a mixture of equal parts of chloride of zinc and chloride of potassium, in the proportion of eight of the former to two of the latter. When the salt is in a state of fusion, the metal to be coated is placed in the bath, and allowed to remain there till a coating of sufficient thickness has been obtained; it is then withdrawn, and any parts of its surface imperfectly covered are sprinkled with sal ammoniac, and the sheet of iron again immersed in the bath.

To Coat Iron with Silver.—The metal must be first amalgamated with mercury by the following process:—12 parts of mercury, 1 of zinc, 2 of sulphate of iron, 2 of muriatic acid, and 12 of water, are mixed together, and heated in an open vessel to about 200° Fah.; the iron is then immersed, and the mercury rubbed on its surfaces until amalgamation is effected. The silver or alloy is to be melted in a crucible, and the amalgamated iron placed therein, when a coating of silver or alloy will be deposited.

To Coat Iron with Copper or Brass.—The copper or other coating is to be melted in a suitable vessel, and a stratum of borosilicate of lead placed on its surface; the iron is then to be plunged into the molten metal, and retained there until a coating is deposited on it. Iron coated with the tin or lead may be treated in a similar manner. Another method of coating iron with copper is to place in a crucible a quantity of chloride of copper, upon which is laid the iron to be coated, and over that a quantity of charcoal. The crucible is then submitted to a red heat, the chloride of copper is fused, and a coating of copper deposited on the iron. Or the vapour of chloride of copper may be employed for the same purpose. The coating of copper thus obtained may be converted to one of brass, by exposing the sheet of metal to the vapour of zinc in a closed vessel.

PRODUCTION OF GOLD BY ARTIFICIAL MEANS.

M. THEODORE TIFFEREAU states that he has discovered the means of Making Gold. In a paper read to the Paris Academy of Sciences, entitled, "The Metals are not Simple but Compound Bodies," he asserts that he proceeds upon a principle admitted by all chemists, "that the properties of bodies are the result of their molecular constitution;" and he adduces numerous examples in chemistry, in which bodies assume different properties according as they have crystallized in one form or another, although their composition remains the same. All that he had to seek was a substance which, by its catalytic forces, would act upon the body which it was desired to transmute, and then to place this last under certain conditions in contact with it to effect the change. He believes that there are but very few simple substances in nature, and considers that the forty metals now assumed to be such, are, in reality, combinations probably of one radical with some unknown body hitherto not studied; but which of

itself alone modifies the properties of this radical, and thus presents us apparently with forty bodies, whilst, in reality, there is but one. If any one have discovered this body which has hitherto escaped the researches of philosophers, and can cause it to act on any given metal, is there anything surprising that he can change the nature of the metal by giving it, with a different molecular constitution, the properties of that metal in which this constitution naturally exists? This M. Tiffereau asserts he has done.

MANUFACTURE OF IRON.

MESSRS. B. P. WALKER, of Wolverhampton, and J. Warren, of Mile End-road, have patented an invention, which consists in first melting the iron in a cupola blast-furnace, or refining fire of the ordinary construction; thence it is conveyed in a fluid state to an improved puddling furnace, where it is kept in a high temperature, and mixed with suitable "fluxes," and subjected to the action of carbonic oxide, oxygen, and other gases, in order to purify it from those substances the presence or absence of which constitutes the difference between wrought and cast iron. It is obvious that in place of melting the iron in a separate furnace, it may be at once melted in the puddling furnace. The patentees' claims are:—1. The improved process or mode described of manufacturing puddled iron. 2. The mode of manufacturing puddled iron, wherein a movable containing vessel or furnace is employed for the purpose of agitating, and consequently "puddling," the liquid metal.

BRASS CASTING.

THE casting of the Brass Screw Propeller for the *Agamemnon*, 94, screw-steamship, at the foundry at Woolwich Dockyard, is thus described:—

The quantity of metal required for the casting was about eleven tons, and the time occupied in running it first into an iron pot made for the purpose, and subsequently into the screw propeller mould, was about twenty minutes. The iron pot was expressly made for being used when large castings take place, and is so constructed that there is very little chance of serious accidents occurring, as has been the case in some foundries, through some of the boiling metal falling on the men. The officers present were much gratified by the excellent manner in which the men were enabled, by the working gear, to gradually turn up the iron pot, containing eleven tons of fluid metal, and pour it into the mould; while the pot was suspended by a powerful crane, without the slightest apprehension of danger should any of the men withdraw from the gear, as it would remain safely in the position in which it was left until they again proceeded with the operation. The screw was cast eighteen feet in diameter, but it was to be reduced, when finished, to about sixteen feet, and the weight to about eight tons.

BRASS TUBE-MAKING MACHINERY.

AN ingenious Machine for making Brass Tubes without seam, the invention of M. Degrand, has been established in France, and pro-

mises very excellent results. The tubes are cast in brass, (say) twenty inches long, and of a great thickness. These are then put on steel mandrils, the diameter of which answers to the interior diameter of the finished tube. The tubes on the mandrils are then placed in the machine, and passed between fluted rollers under a considerable pressure. A reciprocating motion is given to the tube on which the mandrils are fixed; and, at the end of each stroke, the tubes are slightly turned round, to expose a fresh surface to the action of the rollers. A continuation of this process swages out the short thick tube to a long thin one, of the desired dimensions. A machine, under the same patent, has been set to work in England; and, having been constructed after the one above-mentioned, is still more simple and effectual. Under the ordinary system of making brass tubes, the brass is cut into sheets of the proper size, the alternate edges are bevelled off in a planing-machine, and the plate is then bent on a mandril with the hammer, and brazed, the bevelled edges forming the joint. The rough edges are then cut off in a lathe, and the tube cleaned with acid to finish it.—*Artizan.*

PATENT METAL-DEPOSITING PROCESS.

MESSRS. MORRIS & JOHNSON have patented a process which embraces the Deposition of Alloys of gold and silver, German silver, brass and zinc, all of which can be deposited with ease, certainty, and despatch upon any metals whatever; and particularly upon iron. Thus the patentee can deposit metallic alloys on surfaces composed of malleable iron, wrought-iron, cast-iron (which is found to require great battery powers), steel, soft iron, tin, zinc, lead, copper, and all the inferior metals. This process also enables the thickness of the deposit to be adjusted to the greatest nicety.

There are some points incidental to this patent of a new and very important character. It is well known that hitherto silver has not been successfully deposited upon steel, without having recourse to an intermediate coating of copper. The advantage to the practical operator of being able to dispense with this intervening step, which greatly enhances the cost of the process, and the time consumed in accomplishing it, will be readily appreciated. In several other metallic combinations the same observation will apply in a greater or less degree; and it may be considered, for this reason alone, that Messrs. Morris and Johnson's patent will become extensively available in a great number of important manufactures. Hitherto, in certain of these, the difficulty experienced in depositing upon iron and steel has been the want of adhesion; but by this invention perfect adhesion is secured, together with any thickness of coating. The beauty of the brass deposit, aided by the fineness and high polish of the surface, presents a close resemblance to gold.—*Mechanics' Magazine,* No. 1554.

DETECTION OF IRON SHILLINGS AND SOVEREIGNS.

BY applying a small pocket magnet to a counterfeit coin of the above kind, it is instantly attracted, and may thus be lifted up from

a table, whereas genuine coins are unaffected. A delicately-suspended magnet needle is a still more sensitive indicator.

EXTRAORDINARY LENGTH OF WIRE FROM ONE PIECE OF METAL.

A REMARKABLE specimen of the ductility of copper has been manufactured at Mr. Walker's mills, Fazeley-street, Birmingham. The metal referred to weighed about 123 lbs., which was drawn out to a length of upwards of four miles, to be laid down as a line of telegraph without link or weld.

WROUGHT-IRON BY A NEW PROCESS.

AN improvement in the Manufacture of Wrought-iron has been claimed by Mr. James Renton, of Newark, New Jersey. It consists in the production of pure wrought-iron directly from the ore, with mineral coal; thus dispensing with the time and money-consuming process of reducing it first to pig-iron, and thence to wrought-iron by puddling, or with charcoal. An Association called the American Iron Company has recently erected works in Newark, the right to the new process having been secured to them for New Jersey. The chief advantages claimed for the invention are, that the iron is produced for some 20 dols. per ton less than the puddled or charcoal iron, and that it is worth 10 dols. per ton more, on account of its superior quality; that a greater quantity of the iron is extracted from a given amount of ore than by the old process; and that it is the only process by which pure wrought-iron can be produced. It requires about two tons of ore and one ton and a-half of coal to produce one ton of the wrought-iron. Mr. Mushet, if we rightly recollect, suggested this same process some years since.

EMPLOYMENT OF IRON FOR BUILDING PURPOSES.

MR. CHARLES COWPER, of Chancery-lane, has patented a peculiar method of Manufacturing Iron for Building Purposes. His claims are for wrought-iron beams, with two or more bearing surfaces on their lower flanges, for floors, roofs, bridges, and other like structures; the manufacture of rolled wrought-iron joists of certain sectional forms for building purposes; a mode of constructing hollow wrought-iron beams, breastsummers, door posts, and columns; and the manufacture of rolled wrought-iron bars, of certain sectional forms, for window frames and cases.

CAST-IRON LIGHTHOUSE FOR THE FALKLAND ISLANDS.

MESSRS. GRISSELL have completed this Light-house by order of the Admiralty Commissioners. The shell of the tower, constructed of 1 in. concentric plates with 4 in. flanges drilled at 6 in. intervals to admit 7-8th in. bolts, is in form a frustrum of a cone 47 ft. in height to the balcony floor, with a diameter at the base of 14 ft., at the top 9 ft. Up the centre of the tower an iron column is fixed to take the weight of the lightning apparatus—a catoptric system of the second

class, the manufacture of Messrs. Wilkins, of Long Acre; and on this column are cast pockets to receive the T iron joists, supporting the two wrought floors; the third and topmost floor, secured by the same means, with the additional assistance of cast ornamental brackets, being allowed to project some 3 ft. beyond the outer edge of the structure, with a 4 in. flange, forms a circular abacus 15 ft. in diameter as a capital to the tower, and on this rests the octagonal lantern, ventilation being by means of the vane. The total height of the erection is about 67 ft. The weight of tower and lantern is nearly 50 tons.

IRON BUILDINGS.

MESSRS. BELLHOUSE & Co., of Manchester, have received orders to prepare an Iron Custom-house and Public Store for Payta, in Peru, of very considerable magnitude. The custom-house will be 70 feet square within the walls, and have balconies and verandahs projecting 6½ feet from each face of the building. The main portion of the structure will be of two lofty stories, and there will be a platform 22½ feet square above the roof, from which will rise a circular tower, with a smaller tower above, surmounted by a cupola and flag-staff: the extreme height from the ground to the top of the flag-staff will be above 100 feet. The whole of the exterior will consist of cast-iron uprights and wrought-iron framing, with sheets of galvanized corrugated iron attached thereto by means of bolts and rivets. Each of the stories will have a main central passage 13 feet wide, from which the various rooms and offices will be entered. The whole of the interior will be floored, lined, and ceiled with wood. The iron store or warehouse will be of a plainer design, consisting of a large building under one roof; the extreme length being 120 feet, and the width 90 feet. The cast-iron uprights of this building will be of the form recently patented by Messrs. Bellhouse. These uprights are in section a hollow column, having side wings cast thereon of such a form that the corrugated sheets will fit in a simple way to the ribs. The main entrance will be at one gable end, and will consist of an arched grated opening, with a gateway, through which a covered area for loading and unloading will be entered, 60 feet long and 30 feet wide.—Messrs. Bellhouse have recently sent out to India the iron roof of a church, calculated to obviate the intense heat of tropical climates. Wrought-iron principals extend from wall to wall across the building. Rebated wooden boards 1½ inch thick, are fastened upon them, and over these a layer of thick dry hair felt is nailed, with a final external covering of corrugated sheet-iron.—At New York a lodging-house is being prepared for the accommodation of 1000 persons. Its height will be eight stories, and the outside dimensions 200 feet square, having a courtyard in the centre. The exterior is being made of iron, and the inner walls and partitions of brick, and it will be thoroughly fire-proof in every part. The cost, including purchase of land, is expected to amount to 400,000 dollars.—*Builder*, No. 552.

Messrs. Newton and Fuller, of Plough Bridge Works, Rotherhithe, have designed an Iron Warehouse, 300 feet long by 130 feet wide,

which will be the largest building of its kind which has ever been exported. The roof and sides are to be formed of corrugated iron; sixty-four cast-iron columns support the roof, all of which are hollow; the girders connecting the columns are made so as to form a rain-water gutter, and at the same time to support the roof and main ties; the light will be admitted through rough plate glass. The whole is designed with the greatest simplicity, every part being a duplicate one of the other. All the parts of the building, even to the foundation stone, will be shipped from England.

ZINC HOUSES.

Mr. Middlemass, of Edinburgh, has constructed several Houses of Zinc, which are much more moderate in price than those of cast-iron, and are of much lighter freight; are not so liable to rust or corrode; and being non-combustible, are better adapted for emigrants than houses made of wood. One of Mr. Middlemass' houses is thus described:—The house is formed of zinc plates, fixed on timber frames—each being three feet broad by eight feet in height. The different parts of the erection are connected in the interior by means of rods and screws; and being placed on sleepers, it is fixed by bolts to the ground, and is amply secure. The interior is divided into three compartments, consisting of a shop or store in front, with space for a plate-glass window, and two rooms behind to serve as a dwelling-house. The front apartment for business is 15 feet by 10 feet 6 inches; and the rooms in the rear are each 10 feet 6 by 7 feet 6 inches—both being ventilated, well lighted, and having an air of comfort. The height to the eaves is about 8 feet, but to the apex of the roof 12 feet. The exterior presents a smooth surface of zinc; but within, the framework admits of the walls and ceiling being easily lathed and plastered, lined with wood, or tastefully adorned with canvas and paper. The facility of construction is one of the chief characteristics of the invention. The whole does not exceed two tons in weight, and is easily packed in two boxes, the wood of which, being grooved, forms the flooring of the portable premises when they are set up in the colony.

HUNTER'S PATENT ANCHOR.

In Mr. Hunter's Anchor the form of the palm is something like an inverted plough, the concavity being in front; so that when the ship draws upon the anchor, it is more inclined to penetrate deeper, than to be drawn through the ground parallel to the surface. But the chief feature is the stock. Until recently, the stock has only answered the purpose of "canting," or placing the anchor in a position for entering the ground. Now, as the stock lies at right angles to the line of traction, it seems evident that it might be adapted to the purpose of holding; but the great difficulty, we understand, in effecting this object, arises from the inability to construct anything at this part of the anchor that would not foul the cable, and, also, not have the very great disadvantage of increasing the weight. This the patentee ex-

pects to have accomplished by making the stock of iron plates, hollow, convex next the arms and concave on the other side, so that it acts like a short arm, extending from one side of the stock to the other; and thus becoming a most efficient and powerful auxiliary to the arm, and adapting the anchor for either hard or soft ground.

FIRE-PROOF BUILDINGS.

MR. J. BARRETT has read to the Institution of Civil Engineers a paper on the "Construction of Fire-proof Buildings." The author first introduced some remarks on the use of timber for building purposes, referring to its injurious effects in weakening the walls of buildings, its combustibility, and its liability to dry-rot and the ravages of insects;—the great loss of life and the vast destruction of property resulting from its too common use in buildings rendering essential some strong measure, by which the public safety would be insured. The iron-girder and brick-arch system of construction was then referred to; and the evils which might result from the adoption of that principle were exemplified by reference to the fall of the cotton-mill at Oldham, in 1845,—where the lateral thrust of one of the arches having fractured a cast-iron beam, had caused the sudden destruction of the entire building. The author contended that a system liable to produce such calamitous results could not be regarded with that degree of confidence which should be felt where many lives and much property were at stake. The paper then proceeded to describe the system of fire-proof construction which had been to some considerable extent adopted as a substitute for the usual methods of building, and as a remedy for the defects complained of. The chief objects to be accomplished were described to be—making each floor of the building fire-proof, so as to prevent the communication of fire from story to story, avoiding all lateral thrust or weakening effect upon the walls, securing the building from the attacks of dry-rot, giving increased durability to the structure, and rendering it at the same time practically sound-proof; combining these advantages at the same time with simplicity and economy of construction. In accomplishing these objects, joists of wrought or rolled iron of an improved form, combining lightness with great strength and economy, were used; and by the employment of layers of incombustible materials, chiefly concrete, supported by and consolidated with the joists, a strong and solid fire-proof foundation was obtained, upon which any description of finished surface adapted for a floor or roof might be laid. The various parts of the structure having been minutely described, it was stated, that in point of strength the floors even of an ordinary dwelling-house constructed on this principle would, if crowded to the utmost possible extent, be loaded with only one-fifth of their breaking weight. The fullest details were given of the actual as well as the relative cost compared with other floors under all circumstances; and it appeared, from a detailed comparative statement of the cost of different floors for domestic buildings, given in an appendix to the paper, that substantial and well-constructed timber floors were actually more costly than the fire-proof floors finished with a surface of cement

—and that the fire-proof foundation finished with the ordinary boarded surface was, on the average, very little more expensive than ordinary timber floors.—*Institution of Civil Engineers.*

GLASS AND IRON PAVEMENT.

MR. HYATT, of New York, has invented a Pavement of Glass and Iron, by which underground apartments are made as pleasant as those above. The illuminating portion of the pavement is made up of sections, each section being a cast-iron grating, all the interstices of each grating being fitted with glasses to correspond. Every glass might be destroyed, and a safe footpath remain ; and every glass might be destroyed, and burglary be still prevented.

IRON PAVEMENT IN AMERICA.

IRON pavement laid down in the streets of Boston has, it is said, been eminently successful. After seven months' wear, and the frosts of winter, the street is said to present as smooth a surface [rather too smooth, may it not be?] as when the pavement was first laid, and the sensation of riding upon it is like that of passing over a bridge. This pavement, which is said to have been invented by Mr. W. D. Terry, is described as consisting of cylindrical boxes of cast-iron, about a foot in diameter, divided into compartments so small as not to admit the hoof of a horse. These cells are filled with gravel, or any suitable substance, and the upper surface so grooved as to prevent the possibility of a horse slipping upon it. The boxes are firmly bound together by flanges and commissures, yet the pavement, it is added, can be easily taken up in case of necessity.—*Builder*, No. 556.

IMPROVEMENTS IN THE PRESERVATION OF WOODS AND METALS FROM DECAY.

THE composition specified in Machabee's patent is formed by melting together three 1-5th parts of vegetable tar, one part of mineral tar, one-sixth part of resin turpentine of Pinus Larix, one-third part of wax, one-sixth part of white grease, with or without the addition of one-third part of Roman cement, and a similar quantity of hydraulic lime in fine and sifted powder. The mineral ingredients are added to the others when in a boiling state, but are only required in those cases in which the material to be coated with the composition of mastic is to be exposed to the action of heat. The composition is applicable to wood, metal, brickwork, &c., the surfaces of which must be well cleaned prior to its application, which may be effected by means of a brush, whilst in a heated state, and any number of coats may be employed. When the composition is used for covering the inner surfaces of walls, a coating of plaister is applied over the mastic.—*Pharmaceutical Journal.*

PRESERVATION OF TIMBER.

MR. H. ROTTER BURT, C.E., has read to the Institution of Civil Engineers a paper on the "Nature and Properties of Timber, with

notices of the several methods now in use for its preservation from decay." The author first examined the different species of home and foreign-grown timber, their various properties, uses, tendencies to decay, under certain circumstances; the most apparent causes of dry-rot, the formation of fungi, the action of wet and of heat; noticing the extraordinary duration of specimens of timber found in Egypt, in the ruins of Nineveh, and in the more recent monastic and castellated edifices of this country.

The chemical constitution of wood was examined in order to trace the origin of decay, and to lead to the consideration of the most efficient means of arresting it. The necessity for some efficacious and yet moderately cheap system of preserving timber, was insisted on, from the great demand for railway and other engineering works, not only in Europe, but even in the East Indies; where it was remarkable, that the wood which would resist the climate and the ravages of the white ant, was only to be found at such distances inland, that the expense of carriage, in a country devoid of good means of communication, rendered it more economical to buy fir timber in the north of Europe, convert it to the required dimensions, saturate it with creosote in England, and convey it by sea to India, for the use of the railway now in course of construction in that country.

The earliest record of preserving animal and vegetable substances was traced back to the Egyptians, whose mummies were embalmed by being boiled in pitch, found floating in the lakes; the linen and the timber so preserved gave the first idea for adapting the process to the wants of the present period, and several of the patents granted were enumerated and commented on; the greatest space being devoted to those of Kyan, for chloride of mercury; Burnett, for chloride of zinc; Margary, for acetate or sulphate of copper; Payne, for the use of two solutions in succession, mutually decomposing each other, and forming an insoluble substance in the pores of the wood; and Bethell, for creosote, or oil of coal-tar;—which last had, by its extensive employment in harbour, railway, and other engineering works, proved, that when properly executed, the Preservation of the Timber from decay and from the ravages of insects might be considered complete.

The paper was illustrated by a series of models and drawings, showing the various apparatus for the several processes, enlarged diagrams of microscopic views of sections of several kinds of timber, both in the natural state and after being creosoted; experiments on the degrees of saturation by the process, and on the transverse strength of the timber; with the results of the improvements introduced into the system by the author.

In the discussion on this paper, the theory of the various processes was carefully described; the action of the solutions in water of metallic salts, such as chloride of mercury (Kyan's), chloride of zinc (Burnett's), or sulphate of copper (Margary's), was, if the mixture was sufficiently strong, to coagulate the albumen in the sap; but the fibre was left unprotected; and it being a property of albumen

to render innocuous the corrosive sublimate combined with it, the marine worm, or the white ant, would immediately attack wood so prepared.

Creosote had the same effect of coagulating the albumen, whilst it gave a waterproof covering to the fibres, prevented the absorption of water, and was so obnoxious to animal life, that, hitherto, no instance had been adduced of well creosoted timber having been either touched by decay, dry-rot, or the marine worm ; and the trials made in India showed that it was equally objectionable to the white ant.

The chemical products of the distillation of coal tar were described, and it was shown that the naphthaline was essential as an antiseptic ; that the process should be carried on with heated creosote, in order that this product should not crystallize in the capillary tubes of the wood; and that it would be advantageous to desiccate the timber before it was submitted to the process. For this purpose, it was proposed to dry the wood by smoking it in an oven, whence it should be conveyed, on the same trucks, into the cylinders, exhausted to the extent of 26 or 27 inches of mercury, and then saturated with heated creosote, under a pressure of 120 lbs. to 150 lbs. per square inch. Wood thus saturated to the extent of 7 lbs. or 10 lbs. per cube foot, might be presumed to be indestructible, as when, even by a less perfect process, such an extent of saturation had been attained, no authentic instance of decay, or injury from worm, had ever been adduced ; numerous specimens of wood so prepared, that had been underground and in the sea, for from twelve to twenty years, were exhibited, and all were perfectly sound.

The alburnum or sapwood absorbed the creosote more readily than the heart of the timber, which could, however, be penetrated by the solution of chloride of zinc (Burnett's process), of which it was stated, that careful analysis demonstrated its intimate combination with the timber ; it was therefore suggested, that in cases where the complete preservation of the timber was of vital importance, and expense was not a consideration, the wood should be first subjected to Burnett's process and then be creosoted, by which combined means it would become indestructible.

It was shown, that dry wood only should be subjected to creosoting ; by that process sapwood, otherwise almost useless, could be rendered very serviceable ; and that for piles for marine work, whole round timber should be used, because the outer portion, or the alburnum, was so much more readily saturated with the oil ; and this prevented the worms from making an inroad into the heart.

Timber should not be kept floating in ponds, as in London, but it should be stacked in the docks, as in Liverpool and Gloucester ; when the tubes were filled with moisture no oil could be forced into them, even by the heaviest pressure.

By returns from the Leith Harbour works, it was shown, that the average quantity of creosote absorbed by the timber was $57\frac{1}{8}$ gallons per load, or 577 lbs. weight, forced into 50 cubic feet of wood.

Piles, 14 inches square, of unprepared timber, at Lowestoft harbour, were shown to have been eaten away to 4 inches square,

in four years, whilst creosoted piles, of the same dimensions, driven alongside them, were perfectly untouched; specimens of both were exhibited.

Some specimens were shown of curious coke, produced from the pitchy residue of the distillation of creosote; it was quite free from sulphur and earthy particles, and was found to be very valuable for smelting iron, for which purpose it was beginning to be largely used near Birmingham.

It appeared to be admitted that all the various processes somewhat reduced the transverse strength of the timber when dry; and the metallic salts affected the iron bolts, or fastenings.

The natural juices of some woods did this; and a bolt was exhibited which had united beams of elm and pitch pine, and was corroded entirely away at the junction.

It was shown, that on some railways in the north, unprepared yellow pine had been down, as longitudinal sleepers, for sixteen years, and was still perfectly free from decay, although its natural term had expired by being crushed under the loads constantly travelling over it. The effect of "greenheart" timber in resisting the attacks of worms, was particularly noticed, and it was admitted, that but for its great cost it would be extensively used.

Experiments were mentioned, that were made at the Royal Pier, Southampton, on timber prepared by various processes; and the result was, that the creosoted wood alone resisted the attack of the "Terebrans," with which that water was peculiarly infested.

The discussion was renewed by the exhibition of specimens of timber, rendered uninflammable by Sir W. Burnett's process (chloride of zinc). It was stated that in the most intense fire, timber, or even linen, so prepared, could only be charred, and would never burst into flame.

The President exhibited, from Southampton, portions of unprepared, and of creosoted, timber, which had been attached to the worm-eaten piles of Southampton Royal Pier, in February, 1848, below the level of high water of spring tides. The specimens showed, that whilst the unprepared and the "Payneized" timber was entirely converted, by the worm, into a mass of disintegrated fibre, the creosoted timber had not been touched by those insects.

NEW LOCKS.

At the meeting of the Society of Arts, on April 20, several communications were read in competition for one of the Society's premiums—No. 83. "For the invention of a good and cheap Lock, combining strength and great security from fraudulent attempts; cheapness, freedom from disarrangement by dirt, and requiring only a small key.

The first was on "Mr. E. B. Denison's New Lock," by S. Mordan and Co.

Mr. E. B. Denison explained the construction of this Lock, of which two specimens had been sent to the Society for exhibition by Messrs. S. Mordan and Co., the makers. One of these specimens

was a large lock for iron safes, and the other a drawer-lock of the usual size. The following is the description which had been sent in by Messrs. Mordan:—

This Lock is submitted to the Society as complying with the requisition in their premium list of this year. It will be evident from inspection that both the tumblers and the "stump" of the bolt have greater strength and means of resistance to force, than in other locks of the same size; while the key of this lock, which is suitable for safes of the largest size, and capable of shooting any number of bolts, only weighs one-third of an ounce.

This smallness of the key in proportion to the size of the lock is not obtained, as in some other safe-locks, by diminishing the size and strength of the tumblers, but by giving the key nothing to do except raising the tumblers, without the resistance of any springs. The bolt is shot by the handle, and the lock is thereby also completely locked without using the key at all, and the key is only required to raise the tumblers again to such a position that the handle can open the lock; whereas in the class of safe-locks above referred to, the ultimate security is only that due to the strength and security of a small lock which is locked into the main bolt by a key made after it is shot by the handle. This mode of locking a door without using a key may be a great convenience to those who are obliged to leave their places of business before the time of locking up, and who are unwilling to leave their keys with clerks, whom they might readily trust to lock up the books and other things by merely turning a handle; it also removes all temptation to leave the key in the lock, which sometimes exposes it to the risk of being stolen, or having an impression taken. At the same time it is free from the objections which apply to spring or self-shutting locks, though it possesses all their advantages.

The makers believe that this lock is quite as secure from picking as the famous American lock, which is much more complicated and expensive, and requires a very large key. The mode of picking which was described in the *Encylopædia Britannica* some years ago, but has lately acquired more celebrity from the performances of Mr. Hobbs, is here prevented, by rendering it impossible to feel or produce any pressure of the bolt on the tumblers, so long as the key, or any other instrument, is in the keyhole. For when the key is pushed into the lock against the curtain, which is held up by a spring behind it, a square plug at the back of the curtain descends into a notch in the bolt, and so prevents it from being moved at all; and it is so constructed that when the curtain-plug is in this notch, the stump does not quite reach the ends of the tumblers, and therefore, although it is perfectly easy to raise the tumblers by any key or picker, their bearing against the stump cannot be felt; and, on the other hand, if the bolt be drawn back by the handle so as to bring the stump against the tumblers, then the curtain-plug cannot be pushed into the notch in the bolt, and the keyhole remains closed against the introduction of any instrument.

It has been stated that most tumbler locks, with keyholes of the ordinary size, can also be opened, by observing and measuring through the

keyhole the distance from the drill-pin, or centre of the keyhole, at which the key begins to leave a mark on the tumblers. This is prevented here by the smallness and depth of the keyhole, both of which render it impossible to get a sight of the tumblers at the point where the key first touches them. In this way, therefore, the smallness of the key adds to the security of the lock, besides the more obvious advantage of convenience of carrying in the pocket, without the temptation to leave it out on account of its bulk; and it also renders it impossible to introduce any instrument of sufficient strength to force open by sheer violence a lock of this strength and construction. By way of security against drilling a false keyhole into the lock, there may of course be a thick case-hardened or chilled cast-iron plate between the lock and the front of the door; and it will be observed that nothing would be gained by drilling into the curtain, as you would only in time come out through the square plug into the inside of the door, and not into the inside of the lock.

As a proof of the indifference of the lock to dirt, as well as its simplicity, the work was left as rough as possible. The tumblers are merely short lengths of hoop-iron, and both the tumblers and the friction-plates between them were left as they came from the roller. In fact, instead of friction being, as in other tumbler locks, a thing to be counteracted as far as possible, the friction in this lock was an advantage, as it helped to keep the tumblers steady, in whatever position they might be required to assume, either by the key or the handle; and for this purpose one or more of the separating plates is also bent a little, so as to make them always act as friction-springs on the tumblers. In tumbler locks of the usual construction, if a drop of thick oil, or any other substance, got between any tumbler and the adjacent tumbler, or plate, it might easily overcome the power of the spring to depress the tumblers, and the lock then came to a "dead lock," as there were no means of introducing a substitute for the power of the spring, so as to bring down the sticking tumbler. If a spring got broken, which occasionally happened where they were allowed to get rusty, the same result took place; whereas, in this lock, there were no tumbler springs, and there was always the power of the handle to bring down the tumblers. It might be observed, also, that the curtain having no opening at all in it, kept the keyhole closed against dirt, and the corroding effects of a damp or smoky atmosphere.

The second paper was on "Mr. Andrews's Snail-Wheel Lock," also by Mordan and Co.

This communication was also accompanied by a specimen, which, it was considered, satisfied all the prescribed conditions, excepting as regards the smallness of the key, which was of the usual size. The makers were of opinion that it was impracticable to make a very small key to a good and secure lock, unless a double action were introduced; for in all single action locks the key must be solid and strong enough to raise the tumblers and shoot the bolt; on the other hand, a double-action lock was incompatible with simplicity and cheapness. The great recommendations of this lock were its great

security from picking; its simplicity and consequent cheapness; its great originality; its unusual strength and durability; its non-liability to get out of order, from dirt or any other cause; the impossibility of making observations or measurements through the keyhole, with a view to making a duplicate key; its easy adaptation to any purpose for which locks were required.

As regarded its security, the tumblers were circular, revolving on a pivot, instead of being oblong, which was the usual form; consequently, it was impossible to feel the pressure of the bolt upon them, as in nearly all existing tumbler locks. The oblong tumblers could only have a limited action in a small segment of a circle, and were therefore susceptible of a comparatively small number of changes, whereas the changes produced by the revolution of circular tumblers were almost innumerable. From the extremely novel construction and arrangement of this lock, it was self-evident that no sight of the tumblers could be obtained which would in any way assist an expert thief to make an instrument to open it. Its simplicity and consequent cheapness were due to the absence of all springs in connexion with the tumblers; to the original form of the tumblers, which enabled them to be stamped out at the press from thin sheet iron; to the simple and direct action of the tumblers on the bolt; and generally to its being quite unnecessary to highly finish any of the parts, and the great ease with which the whole was adjusted. Another recommendation was, that if the key should be lost, the lock could be altered in a few minutes (at little or no expense), by simply changing the relative position of one or more of the circular tumblers.

Mr. Hobbs said he saw nothing in Mr. Denison's invention which was not common to many other locks. The plan of turning the lock by means of the handle was common. Small keys for strong locks were also common; and in the French department of the Great Exhibition, there was a lock exhibited in which six large bolts were shot with a key no larger than a watch-key; but he thought the smaller the key the greater was the chance of imitating it.

Mr. Hobbs also made other objections, which were replied to by Mr. Denison.

Upon the decision of the Society, which awarded their medal, and a premium of £10, for a lock that answered all the requisitions, Mr. Hobbs states:—

"On calling at the Society's rooms to inspect this piece of mechanism, I was surprised to discover that it was constructed on precisely the same principle as the 'Yale Lock,' described in a paper read before the Society in January, 1852, and of the same construction as locks manufactured and sold by Mr. Cotterell, of Birmingham; in short, that it had no claim whatever to be regarded as a new invention by the Committee of the Society, however honestly it might have been submitted as one by the maker. The want of originality in the lock, *supposing that it answered all the conditions* named in the circular, might have been passed over as a venial offence. This, unhappily, was not the case. That the essential requisite of security—'great security,' as it is expressed in the circular—did not belong to it, was proved by a very simple experiment. To be brief, *I picked this prize lock, in the presence of parties connected with the Society, in the short space of three minutes!*"

CHUBB'S IMPROVED LOCK.

MESSRS. CHUBB, of St. Paul's Churchyard, and Mr. John Goater, lock maker, have patented certain improvements in locks and latches.

The first of these improvements consists in forming the sliding-bolt of a lock in two parts, the one hinged to or moving on the other, a spring being applied between the parts of the bolt with a tendency to keep them correctly together. The key only acts on the movable part of the bolt, and any pressure put on the bolt for the purpose of acting on the tumblers separately will be interfered with by the movable part, which rises so as to press against the stump. The tumblers are provided with inclined projections, which, acting against a stud on the movable part of the bolt, cause it to rise when the bolt is shot; and any applied pressure tending to force the bolt back is resisted by the stump till all the tumblers are lifted to their correct positions by a true key. The lock is provided with a screen to the keyhole and detectors to the tumblers.

Another improvement is, that on the screen is affixed a false bit, which acts on the tumblers when the screen is turned, but not correctly, unless it is turned by the proper key. This part of the invention is more particularly applicable to latches or locks with lifting bolts.

JENNINGS'S NEW LOCK.

MR. LEWIS JENNINGS, of Fludyer-street, Westminster, has patented an improved construction of Lock.

This lock is composed of a series of permutation plates, pierced with a central hole for the key, and arranged within a rotary cylinder or casing, furnished with a projection to receive the action of the key, and with recesses in the outer periphery to receive tumblers when all the plates have been brought to the proper point. The key is formed of a similar number of plates, each with a recess of a different length to act in succession on the permutation plates, and bring them round to receive the tumblers, which are worked by one of the plates made cam-formed for the purpose. The case containing the permutation plates and tumblers is surrounded by a permanent flange or case recessed to receive the tumblers when held out by the plates, so as to prevent the rotary cylinder turning when locked. This cylinder has combined with it an eccentric fitted to a yoke in the bolt, for the purpose of throwing the bolt; the eccentric being at the dead point when the bolt is thrown, so that any pressure applied to the bolt to force it in, will have no tendency to turn the eccentric.

PARNELL'S "MASTER-KEY DETACHMENT."

THIS instrument is an important supplementary adaptation to the "Defiance Lock," invented by Mr. Parnell, of Little Queen-street, Holborn, by means of which a great ulterior purpose is accomplished in that highly ingenious contrivance. There are three principal points in the "defiance lock" which deserve notice—the expanding bit of the key, the revolving curtain or cap, and the serrated notches in the "stump" and in the levers. First, with regard to the key.

When this has moved through a given portion of its revolution,—about a quadrant,—it comes in contact with a "detector," or obstacle, which would arrest the farther progress of a false key. The true key passes the point by means of its expanding bit, which is a piece of hard steel, sliding outwards upon the ordinary bit. At this critical point of the course of the key, a steel cam-plate, or eccentric, at the base of the pin, comes into play. By the revolution of the key against this plate, the movable part of the bit is thrust outwards, and presses against the detector, enabling the key to pass the point, raise the levers, and shoot the bolt. In returning, the expanding bit is brought back by another arrangement equally simple. The revolving curtain is made of hardened brass. It revolves about the pin as a centre; and, therefore, with the key, and its upper plate, is in accurate contact with the interior surface of the lock-plate. An aperture is provided for the key in this plate, and the cap extends around the side of this aperture downwards through the whole depth of the lock, forming a small chamber, within which the bit fits accurately; so much so, that the finest point cannot find access to the works. As the key moves, it carries the curtain with it, the solid part of which closes over the keyhole. With a false key, which a burglar would have infinite difficulty in admitting into the curtain, the curtain might be brought up to the detector, and there the attempt would fail. The notches in the stump and in the levers take the strain off the levers, supposing an attempt could be made to force them by any extraordinary means, though these seem utterly excluded. There are other points worthy of notice in Parnell's lock; but we have stated enough to render the description of the master-key detachment comprehensible.

The intention of this contrivance is to enable the possessor of the master-key not only to open any number of locks of the same suit, where a variation of keys may be necessary, but also to throw them all "out" at pleasure; so that none of the ordinary keys can be of the slightest use until the master-key, by its insertion in the lock, puts it into working order for them again. In fact, it locks the lock even against the ordinary key, and acts as effectually as if that key had never been in the lock at all, thereby rendering it for the time useless. The mode by which this is effected is as follows:—At the end of the levers is a strong spring, having a bevelled angular catch on the upper end, with a small stud, about a quarter of an inch in diameter, projecting to the outside of one or both sides of a door, if desirable. On this catch one or more levers are made to fix, quite independently of the working levers of the lock itself.

In a bank, prison, or other large establishment, where a number of keys are in use by various persons up to a certain hour, it often becomes desirable that the operation of these keys should cease. The only thing required for that purpose is, that the possessor of the master-key should push the stud on the outside of the door about the sixteenth of an inch on one side; by which means the extra lever or levers, which had hitherto rested on the spring catch, are instantly liberated, and falling downwards, take possession of the bolt. When

it is required to put the bolts "in" again, it is only necessary to insert the master-key, turn it round about one-third of the unlocking movement, when the extra levers are lifted on the spring catch, where they remain as before, until it is wanted to detach them again.—*Mechanics' Magazine*, No. 1541.

ELECTRO-MAGNETIC LOCKS.

MR. F. WISHAW has patented the application of Electro-magnetism to Locks; whereby, either in addition to the ward system, or independently of it, all the immense force of magnetic adhesion may be brought to bear upon bolts and bars, so as to defy the mere mechanical efforts of lock-pickers. The principle is so obvious that we need not enter into details which can be so much varied: it is the application of electro-magnetic apparatus in general to locks, bolts, or bars, if we understand aright, which Mr. Wishaw has patented, not any peculiar form of lock. In all cases where the principle is to be applied from within, as when indwellers secure the doors and windows of a house, the advantage to be thus derived from electro-magnetic fastenings is evident; but where they are applied from without, so far as we can see, there must be dependence either on concealment of the *key*, if we may so call it, to the apparatus itself, or on the use of warded locks, in aid of which only the apparatus could then be used. Thus, a bank-safe might be fastened by electro-magnetism, but then the wires must be conducted through some secure course to the spot from which the safe is to be either fastened or unfastened. Mere concealment of this spot could scarcely be trusted to; and if warded locks are to be ultimately trusted, might they not, in many cases, just as well be primarily trusted? Where a manager lived in a room or house adjoining, however, the case might be different.

EXTRAORDINARY CLOCK.

MR. COLLINGS, of Thornbury, Gloucestershire, has constructed an Eight-day Clock, with dead-beat escapement maintaining power; it chimes the quarters, plays sixteen tunes, plays three tunes in twelve hours, or will play at any time required. The hands go round as follows:—One, once a minute; one, once an hour; one, once a week; one, once a month; one, once a year: it shows the moon's age, the time of rising and setting of the sun, the time of high and low water, half-ebb, and half-flood; and, by a beautiful contrivance, there is a part which represents the water, which rises and falls, lifting the ships at high-water-tide as it were in motion, and as it recedes leaves these little automaton ships dry on the sands; it shows the hour of the day, day of the week, day of the month, month of the year; in the day of the month there is a provision made for the long and short months. It shows the twelve signs of the zodiac; it strikes or not, chimes or not, as you wish it; it has the equation table, showing the difference of clock and sun every day in the year.

REGISTERING APPARATUS FOR PUBLIC CARRIAGES.

MR. W. NEWTON, of Chancery-lane, has patented certain improve-

ments in machinery or apparatus applicable to Public Carriages, for ascertaining and registering the number of passengers who have travelled therein during a given period, and the distance each passenger has travelled. In this improved registering apparatus the indications both as to number of passengers and distance travelled are produced by means of a pencil or marker for each seat in the conveyance, acting against the surface of a strip of paper, which is moved along by means of clock-work. The pencils are actuated by means of levers and connecting.rods, which receive motion from the seats, and the character of the lines marked on the paper shows whether the seats have been occupied or otherwise during a given period, the clock-work being, of course, arranged so as to move the paper forward at a stated rate of progression. During the time the seats are unoccupied, a wavy or zigzag line will be drawn by each pencil; but when the seats are depressed by passengers sitting down, a vertical stroke will be produced, and during the time of their occupation, a horizontal line; the zigzag being again returned to when the seats are quitted.

SCHLESINGER'S PATENT NEEDLE-GUN.

THE arrangements described by M. Schlesinger in his specification, constitute a considerable improvement on the Needle-Gun, or ordinary *zundnädelgewehr* of the Prussian service; and may be said to give full effect to the highly ingenious principle of that weapon, removing several of the inconveniences incidental to it in practice, and for military purposes rendering it wonderfully effective. In the ordinary needle-gun, the explosion of the charge is effected by darting a needle into a percussion composition placed in a wooden bottom, or *spiegel*, within the cartridge, which also contains the gunpowder and the shot. The mechanical contrivances, however, by which this is effected, have hitherto involved several defects, which have considerably diminished the many advantages which this description of fire-arms undoubtedly possesses over the ordinary percussion-lock. In actual service, it will be found that the soldier has a great number of subordinate operations to perform, in the execution of which more or less time is consumed; and in the hurry and excitement of a sharp action, it is more than probable that some of these would be performed in the wrong order, and then it would be necessary to go over the same ground again. First, the soldier must raise the breech-handle, bring it to the left of the guider, and open the chamber. Then, by means of a catch on the second tube, he must draw the needle back. Next he must deposit the cartridge in the chamber. Then he forces the sliding-tube up to the bevelled end of the barrel, and holds it there firmly and air-tight, by pressing the handle to the right against a slightly inclined face on the right-hand side of the outer guide. In this state of the process of firing, the needle is held short of the priming by a second catch of the spring on the second tube; and the soldier now forces the point of the needle into the charge, and brings the piece to the full cock. Lastly, he pulls the trigger and discharges the piece; the consequences of this last movement being the withdrawal of the bolt, the release of the spiral spring, and the instant

entry of the needle into the priming composition. Thus, the soldier, at every discharge of his gun, has no inconsiderable amount of attention to bestow upon the several parts of its mechanism; and whatever practice may do in rendering him familiar with it, and giving him a complete readiness of manipulation, it is undoubtedly desirable that it should be so far simplified that some of these subsidiary operations might be altogether dispensed with.

This great object has been at once effectively and elegantly accomplished in M. Schlesinger's invention; and his form of the needle-gun exhibits a degree of convenience and practical advantage in rapid firing, far exceeding, we should say, anything that the promoters of the needle principle could have supposed it susceptible of. In his arrangement, the act of drawing back the tube which forms the breech, brings the needle back, and so cocks the gun; so that all that the soldier has to do, is to open the breech in this manner, put in the cartridge, force it forward by means of the handle, which is then turned down in the usual manner, and then pull the trigger. In point of efficiency, this arrangement may be judged of from the fact, that the piece may be discharged twenty-five times in a minute—of course without taking aim. This certainly combines the advantage of the breech-loading principle with that of dispensing with the act of priming, in the most admirable and effective manner. For the details of this new gun, with engravings, see *Mechanics' Magazine*, No. 1539.

PORTER'S PATENT REVOLVING RIFLE.

THIS valuable improvement in repeating fire-arms may be discharged nine times without intermission, and loaded nearly as fast as charges can be poured from a powder-flask. Its construction and operation are also beautifully simple, and exceedingly solid and effective. A solid wheel or cylinder, three to three and a quarter inches in diameter, and three-fourths of an inch thick, is fitted vertically in the breech, projecting equally above and below, revolving on journals, and presenting its face closely to the end of the barrel, which fits it nicely, and is thereby closed. The face of the cylinder is perforated with nine chambers an inch deep, each corresponding to the bore of the barrel, and each in turn brought into position by the revolution of the cylinder, so as to match the barrel and form a part of it. These, of course, may all be charged at once. The cylinder rests firmly on its journals, against the action of the discharge, and is also supported at its circumference by the iron portion of the breech in which it revolves. Each chamber has a touch-hole communicating with the centre of the charge and opening on the right side of the cylinder, covered when in position by the end of the cap, which is struck internally and horizontally by a nipple-shaped hammer. The lock, a very simple piece of mechanism, is fixed at one end to the barrel by a hinge, closing and clasped upon the side of the cylinder, when ready for use, but otherwise opening, and allowing the cylinder to be taken out and charged, or exchanged for another, at pleasure. To this is attached a cap-box, accommodating thirty caps, and pre-

senting one at the touch-hole of each chamber as it comes into place. In the military gun, however, the ordinary nipple receiving the cap is connected with each chamber. The trigger guard is also a lever, turning the cylinder precisely one step at each movement, and cocking the hammer at the same time. Three fingers of the right hand pass naturally through the loop in this guard, and by a slight motion downward and back, the cylinder is turned the proper distance as often as the hand can move. This motion, and the pressure of the trigger alternately, are all that is necessary to discharge the piece, which may easily be done nine times in as many seconds. The ball can be driven through a four-inch plank at twenty-five yards.—*New York Journal.*

COLT'S FIRE-ARMS.

An examination of Colonel Colt's weapons will show that they possess most of the chief requirements of perfect Fire-arms. They are easily loaded, and discharged with great rapidity. The ramrod enables the ball to be so tightly fitted in the chamber, that there can be no loss of power by windage at the first moment of discharge, while the central fire and peculiar construction of the nipple cause an instantaneous ignition of the whole mass of powder, which materially adds to its effect. The principle of the best modern rifles is to avoid windage by some contrivance which makes the ball, either before or at the moment of discharge, a tight fit, and in no weapon is this so easily and so perfectly accomplished as in that of Colt. The next thing is a complete and instantaneous ignition of the powder. Here again we give the palm to Colt. With a proper charge the powder cannot be crushed, as the lever ramrod only carries the ball to the right distance in the revolving chamber, and thus it is in the best condition to be acted upon by the large body of flame which is driven into it through the peculiar nipple, which is wide where the cap is put on, and has at its bottom a hole like that of the best kind of blow-pipe. The great practical question is durability, and here the experience of American commanders places the matter beyond doubt. Commander Moore says:—"I know some of these arms that have been in use for nine years, and are still good."

NORTON'S PERCUSSION CARTRIDGE FOR BLASTING.

Captain Norton has practically demonstrated at Cork the powerful effects of his Blasting Cartridge, the *modus operandi* being as follows:—

A triangle is made of three tall larch spars placed over the root to be blasted, a hole being bored by an auger an inch and a quarter in diameter into the most "gnarled and unwedgeable" part of the root; about three inches deeper than the centre a plug of iron of the same diameter as the auger, and an inch and a half long, is then forced into the bottom of the hole, so as to prove a *solid* foundation. The cartridge, with a percussion-cap on each end, is then dropped in, and rests on the iron foundation; a rammer of iron of nearly the same diameter as the auger, and about four inches longer than the depth

of the hole, so as to project about four inches, is then inserted, and may or may not rest on the head of the cartridge. A block of wood, about sixty pounds' weight, suspended by a strong cord vertically over the projecting head of the rammer, is then allowed to fall on it, when, by the momentum or blow, the explosion takes place; and in no one instance out of more than a hundred trials has the rammer been blown out, or, as military engineers term it, "gunning" occurred. In one instance the cartridge was made of tin, so as to be waterproof; and when it was inserted and the rammer placed over it, water was poured in; the explosion was perfect: this was to demonstrate the blasting of rocks under water lying in the way of navigation. The charge of powder in these cartridges is about an ounce of Hall's powder. It is probable that the *fourth* part of the powder used in the present manner of blasting will be found by *this* method to be sufficient.

In the above experiment the object was to remove by one blast the largest forest tree while standing in a growing state, where timber is so thick and dense, as not only to be valueless and pestiferous, but a great obstruction to the cultivation of the land, as in America and New Holland. Mr. O'Brien, of Castle White, Cork, having kindly given Captain Norton permission to operate on a large old poplar tree, three feet in diameter near the root, a hole was bored horizontally within two feet of the ground; and the cartridge and iron bolt (which bolt does the duty of the most perfect tamping) being inserted, a heavy block of wood suspended from a large iron nail, struck into the trunk of the tree, was drawn by a long cord attached to it, about a foot from the projecting head of the bolt, and then let go, so as to strike it like a pendulum or the knocker of a hall-door, when the instant explosion rent the trunk of the tree, and caused it to fall by the pull in the direction chalked out for it by a rope attached to an upper branch of the tree. The effect of this percussion cartridge is like that of the rifle percussion shell, the iron bolt acting like the breeching of the shell.

BLASTING ROCKS.

Mr. A. Stickney, of Norwich, Vt., has invented an Apparatus for Blasting. It is a platinum tube, about 10 inches in length, with holes in its side; connected with this is an iron tube of any required length. This is the apparatus; and now for the operation. A hole is drilled in the rock to any depth; this tube is filled with charcoal and ignited in the platinum, and inserted in the drill-hole. A blacksmith's bellows is applied to the upper end of the tube, and the most intense heat is forced through the small holes upon the sides of the rock, scaling it off in fine powder at a rapid rate. When the heat is sufficient, the tube is withdrawn and water poured in, which enlarges the hole at the bottom. The effect of powder upon a rock when confined in such a way must be tremendous. The experiment has been tried with the most perfect success.—*Boston (U.S.) Transcript.*

GREAT BLAST IN THE ISLE OF WIGHT.

THE Blackgang Cliff, in the Isle of Wight, has been blown up, and the process was an interesting one. Eight holes were bored, and filled with about 2 cwt. of powder, seven of which were fired, and caused a vast quantity to fall; but the most prominent part and the most weighty still remained. This piece, in which was bored the eighth hole, was rent away from the body of the cliff at the top about 5 yards. Mr. Dennis placed his life in most imminent danger, by putting an iron bar across, and crawling on it to set fire to it; and in about two minutes a very loud report warned the bystanders, of whom there were about 150 present, that it would fall; and it certainly was a grand sight, for some hundredweights seemed for a time suspended in the air, and then fell with a tremendous crash. One piece measured 4992 cubic feet, which, reckoning the usual weight of 14 feet to a ton, would weigh upwards of 350 tons. Several other pieces, of from 50 to 150 tons weight, also fell, and are lying on the ground. This tremendous weight, on land which was completely saturated with water, as most of the land in the Undercliff is, so shook it, that about 250 yards of the high-road is entirely gone, and the common, for some distance round, is completely rent in pieces.

NEW PLAN FOR THE VENTILATION OF COAL VESSELS.

THE frequent and lamentable explosions which have so often and recently occurred to the vessels and colliers engaged in the shipment of coal from the Welsh ports, have caused the adoption of a most ingenious plan for the prevention of these accidents. Vessels proceeding on long voyages, laden with the Welsh steam and other coals, are now generally fitted after the new manner, and into such favour has it risen that it is deemed indispensable by the Liverpool commercial community that vessels engaged in the foreign coal trade should be fitted up on the improved system, which is done after the following manner. The great object is to prevent the accumulation of "foul air," and to do this a thorough draft or ventilation is gained by lining the hold, before the vessel is loaded, with sleepers, bearing alternately from the deck half-way to the keel, and *vice versâ* from the keel upwards. These are 4 or 5 inches in depth, and 3 feet apart; and on them is laid a flooring, which passes the whole length of the hold, leaving the wide space underneath for the purpose of fresh air. This current is sent down from the decks by means of six wooden funnels, 12 or 18 inches square, which, placed perpendicularly, run two from the fore, main, and after-decks each, down to the space left at the bottom of the hold, thus securing an uninterrupted passage for the fresh air. The inner surfaces are thus kept cool, and vessels on a six months' voyage need not apprehend any danger from explosion, as was formerly the case.

BLOWING UP A LOFTY CHIMNEY.

NEAR Warrington Junction, about 20 miles from Liverpool, was a lofty Chimney, connected with Messrs. Muspratt's chemical works. It was 406 feet high; 46 feet diameter at the base; 17 feet diameter

at the summit; contained 3,500,000 bricks—3500 tons in weight; and cost £7000 erecting. The works have not been in operation for about eight months, owing to arrangements being made to remove them to another locality. There being, therefore, no further use for the chimney, it was blown up the other day, under the superintendence of Mr. Stephen Court, architect of the St. Helen's Canal and Railway Company. A number of holes were delved round the base; and fourteen charges of gunpowder were inserted. At half-past two o'clock the train was fired. Nine charges exploded without any apparent damage being done to the stability of the shaft; but the report of the tenth had no sooner been heard than the chimney was rent from top to bottom, and the huge fabric fell, crumbling away gradually from the base upwards. The whole of the column fell nearly within the circumference of its own base. A dense cloud of lime-dust hid the ruins for a few seconds; but when it cleared away, the 3,500,000 bricks were perceived in the shape of a huge mound.

COMPLETION OF A LOFTY CHIMNEY.

A LOFTY Chimney has been finished at Heywood, near Manchester, at the mill of Mr. Richard Kay. According to the local papers, the outside diameter at the base is 23 feet 9 inches, the stalk is 240 feet high, and in that length the outside diameter has been decreased to 7 feet at the top. The inside diameter at the bottom and top is 17 feet 6 inches and 5 feet 6 inches respectively. Nearly half a million of bricks have been consumed in erecting it. The "cap" is of cast-iron, and weighs upwards of 14 tons; the lightning conductor is of copper roping, gold-tipped.

SIMONS'S SAFETY-LAMP.

MR. E. SIMONS, of Birmingham, has explained to the Society of Arts the Safety-Lamp which he has lately invented. The improvement consists in a contrivance which extinguishes the lamp the moment an attempt is made to open it—the great object being to prevent miners from doing so, and thereby causing accidents. He has also applied the self-acting extinguisher to the common Davy lamp. All the scientific men and coal-owners who have seen the lamp approve of it; but the latter say it is too dear. He contends that the cost of five hundred such lamps ought not to be put in competition with the life of a single man. He is anxious that the lamps shall be most thoroughly tested; and, if found to answer, he will forego all claim to any patent right, in order that manufacturers might compete in producing them, and thus lead to their general adoption. The chairman, in the name of the meeting, thanked Mr. Simons for his very valuable offer.

NEW THERMOSTAT.

THIS apparatus for regulating Temperatures and Ventilation, has been invented by Mr. W. Sykes Ward, and consists of a series of flat circular hollow cases, about one foot in diameter and one inch deep, attached together in their centres. Each case contains a small

quantity of sulphuric ether, which is readily affected by change of temperature. The cases, comprising about six, are suspended one under the other, and to the lowest one is attached a weight by a cord that passes over an eccentric pulley. On an increase of temperature the ether expands, and the weight falls down, and it is drawn up again by the pressure of the atmosphere on the external discs of the cases when the air is cooled. By connecting the weight with the ventilators of a conservatory, or other building, the temperature can be thus regulated to any required degree by a previous adjustment of the apparatus.—*Proceedings of the British Association.*

COOLING AIR IN TROPICAL CLIMATES.

At the late meeting of the British Association was read, "the Report of the Committee appointed in 1852 to prepare a Memorial to the Hon. East India Company on the Means of Cooling Air in Tropical Climates," by W. J. Macquorn Rankine. In the absence of Mr. Rankine, one of the secretaries read the Report, which was founded on experiments with apparatus invented by Professor Smyth, described by him at a previous meeting of the Association. The principle of the invention consists in cooling the air by expansion. The air at the temperature of the atmosphere is first compressed in a bell receiver, and the heat generated by this compression is lowered by passing the air through a number of tubes immersed in water, by which means it acquires in its compressed state the normal temperature of the atmosphere—say 90° of Fahrenheit. The air then passes into another inverted bell receiver, where it is expanded to the ordinary pressure of the atmosphere, and during this expansion it absorbs so much heat that the temperature is reduced to 60°. It is then admitted into the room to be ventilated. The compression of the air during the experiments in the first cylinder was equal to $3\frac{2}{10}$ inches of mercury per square inch above the pressure of the atmosphere, and the refrigerator exposed a cooling surface of 1100 square feet, which was considered sufficient to reduce the temperature of the air in passing through the tubes to that of the atmosphere, viz. 90°. The Report stated that by means of this apparatus, 66,000 cubic feet of air per hour might be cooled from 90° to 60°, by a steam-engine of one-horse power, which is required to raise and depress the bell receiver. The advantage of cooling the air by mechanical means instead of by evaporation, was stated to be the avoidance of aqueous vapour, with which the air is injuriously charged by the evaporating process.—*Athenæum,* No. 1351.

FUSION IN A CLOSED VESSEL.

A very ingenious application of scientific principles to determine the point of Fusion in a Closed Vessel, and a remarkable result from High Pressure on Fluids, were incidentally mentioned by the President of the British Association, in his inaugural address, at the late meeting at Hull. Experiments were instituted by Mr. Hopkins, Mr. Fairbairne, and Mr. Joule, to determine the effect of increased pressure in raising the temperature of fusion.

The substance operated on was inclosed in a very strong metal chamber, and the pressure was produced by water forced by a plunger acted on by a long lever down an iron tube, three quarters of an inch thick. Wax was the substance employed; and it was, of course, essential to ascertain the exact moment that it became fluid when heat was applied. As all the apparatus must necessarily be opaque, the melting point could not be seen. The difficulty was ingeniously surmounted in the following manner: a small magnet was inclosed on the top of the wax, whilst outside the metallic chamber containing it, and on the same level, a nicely-balanced magnetic needle was placed. The inclosed magnet acted on the needle and deflected it at a certain angle, from its natural position; but the instant that the wax melted, the magnet fell to the bottom, and the vibration of the needle immediately indicated the fact. It was thus ascertained that under a pressure of thirteen thousand pounds on the square inch, wax requires thirty degrees additional heat to melt it; about one-fifth of the whole temperature at which it melts under the pressure of the atmosphere.

During the experiment, it was observed that the plunger gradually descended in the tube, and on examination it was discovered that the water had, under the influence of the enormous pressure, been forced through the pores of the iron, though three-quarters of an inch thick. On afterwards examining the tube closely with a lens, not the least opening could be seen by which the water could have escaped. This result far exceeds that of the celebrated Florentine experiment, by which the incompressibility of water was supposed to be proved by its forcing a passage through the pores of a globe of silver, very thin in comparison with the three-quarter inch iron tube. It was not ascertained whether any of the melted wax had been forced into the pores of its containing vessel.

ON DRYING GOODS IN WARM ROOMS.

ALTHOUGH water possesses a specific gravity eight hundred and fifteen times greater than that of air, yet it can rise into the air as into a vacuum, and mingle amongst it by the same law that gases diffuse through each other. It is this property of water which enables us to have clean and dry linen; for if it were otherwise—if water was the same as oil—our wet clothes would have to be converted into fuel, and burned in the fire before we could expel the moisture from them. Were it not for this property of water, the calico-printers and woollen-dyers could never dry their pieces in shade, sunshine, or stove-room. When wet goods of any kind are submitted to heat in a room, they soon become dry, because the air receives the moisture, and retains it in its soft embrace, thus enabling us to obtain dry goods and dry clothing by the property of evaporation which belongs to water, and the law of gaseous absorption which reigns among the gases. A curious property of the evaporation of water, discovered by Dr. Dalton, is, that the quantity which will rise in a confined space is the same, whether that space be a vacuum or be already filled with air; hence it is only necessary to know

what quantity of vapour rises into a vacuum at any particular temperature, to know what quantity will rise into the air. Thus, the vapour of water which rises into a vacuum at the temperature of 80°, depresses the mercurial column one inch; its tension is one-thirteenth of the usual tension of air. If water at 80° be admitted into dry air, it will increase the tension of that air one-thirtieth if the air is confined, or increase its bulk one-thirtieth if the air is allowed to expand. A certain fixed quantity of the vapour of water, therefore, can only rise into a certain fixed quantity of air; hence the air of rooms employed for drying goods may become so saturated with moisture, that the fuel may be expended foolishly in trying to expel the moisture from the goods when it is impossible for the air to take it up, and hence the evaporation of water is greatly facilitated by a current of air. This is the philosophic principle of evaporation embraced by Bessemer, and that mentioned under the head of Recent Foreign Inventions, in a late number of the *Scientific American,* for evaporating sugar syrups.

In evaporating by means of hot air, as in drying goods in the stove-rooms of calico print and bleaching-works, when the rooms are heated by flues running along the floors, it should not be forgotten by those who have charge of such drying establishments, that a certain time must elapse after the goods are placed in the rooms, before the air is saturated with humidity; due discretion must, therefore, be exercised not to let any of the hot air escape until it is saturated with moisture.

It has been proposed to us more than once, to employ hot air in raising steam, under the mistaken idea that more steam could be generated with less fuel by the passing of such a rarefied hot body through the water. But in evaporating water by heated air—the way wet goods are dried—the vapour itself carries off exactly the same quantity of heat as if it were produced by boiling the water at 212°, while the air associated with it requires also to have its temperature raised, thus requiring more fuel; hence water can never be evaporated in a drying-room with so small an expenditure of fuel as steam can be generated in a close boiler. These facts are well worthy of attention, inasmuch as they relate to different branches of business, in which very many of our people are interested.—*Mechanics' Magazine,* No. 1554.

GASOMETERS.

Some few years ago, several of the most "eminent engineers" of the day gave evidence before a Parliamentary Committee to the effect that a Gasometer of greater diameter than 35 feet would be dangerous, and recommended that in all cases where this limit was approached, a series of strong walls should be built round the gas-holder in order to lessen the injury which the almost "inevitable" explosion might entail. One has lately been manufactured at Smethwick of 165 feet diameter. The gas-holder of the Philadelphia gas-works, erected in 1850, is 140 feet diameter and 74 feet high; and one now erecting there will be 160 feet diameter and 90 feet high,

with a top nearly flat, having only rise enough to carry off the water, without the usual framing and rafters for sustaining the crown.—*Journal of the Franklin Institute.*

ANALYSIS OF LONDON GASES.

A LECTURE has been delivered at the Royal Institution on the "Employment of Chemical Light for Artificial Illumination," by Dr. E. Frankland. After alluding briefly to the electric light, as being the source of light that most nearly approaches the character of the solar rays, though as yet not perfectly available, Dr. Franklin adverted to the various means of obtaining illuminating power from the animal, vegetable, and mineral kingdoms. As an instance of the production of light from minerals, a piece of iron wire was burned in oxygen gas. It is to vegetable substances that we are mostly indebted for the sources of light; for even the gas extracted from coal, when traced to its origin, may be considered as derived from the vegetable kingdom. As gas is most extensively used as a source of illumination, Dr. Frankland dwelt upon its properties at greater length than on those of other light-giving substances, and he explained and illustrated, by a working model, the manufacture and purification of coal gas. During that process many substances injurious to health and detrimental to the light are extracted, but there still remain some bisulphuret of carbon and other sulphurous compounds, which are very injurious, and extremely difficult to separate from the gas. The production of light by the action of chemical affinity, and the different degrees of heat requisite to evolve light during chemical combinations, were illustrated by several experiments. Phosphorus was shown to produce light at a heat not higher than that of boiling water, whilst it requires an intensity of heat to produce light from the combustion of oxygen and hydrogen gases. The heat of the scarcely visible flame from the burning of those gases was shown by introducing into it pieces of wire and of lime. The latter, though it does not burn, produces, when exposed to so intense a heat, a degree of incandescence that almost equals the brilliancy of the electric light. The difference in the quantity of light obtained from the combustion of the same substance in different supporters of combustion, was shown by burning phosphorus in chlorine, in atmospheric air, and in oxygen gas; in the first it was barely visible, and in the last it was most brilliant. Reverting to the component parts of coal gas, and its value as an illuminating agent, Dr. Frankland explained that the quantity of light depends in a great measure on the proportion of carbon contained in the gas, the solid particles of which during inflammation form points for the radiation of light, in manner similar to the particles of lime when acted on by the hydro-oxygen flame. During the manufacture of coal gas, depositions of carbon take place in the retorts that greatly deteriorate its illuminating power, and large masses of carbon and its compounds were shown which had been taken therefrom. The most generally interesting portion of the lecture referred to the comparative effects of the flames of gas, candles, and oil-lamps, on the heat and atmosphere of rooms, and their

comparative cost. The same amount of light given out by spermaceti candles at the cost of seven shillings can be obtained from gas for fourpence. The objections that have been raised to lighting dwelling-houses with gas were stated to be in most respects unfounded. The heat of gas is occasioned by the greater quantity of light it gives out; and, if the consumers of gas would be satisfied with the same amount of light as they have when burning candles, the heat would not be greater, nor yet so great, for gas generates, in fact, less heat than candles or oil. Neither does the generation of carbonic acid take place to so great an extent during the combustion of gas as of the other ordinary sources of light, especially if the gas be good. The real objection to the use of gas in dwellings arises from the generation of sulphuric acid, and if the gas could be deprived of those injurious qualities it would be the most sanitary as well as the most economical light that could be used. The ventilating burner invented by Professor Faraday, carries off all the noxious products of combustion, and thus practically bestows on coal gas the sanitary property which makes it superior to all other modes of illumination. Dr. Frankland concluded by explaining the structure of Faraday's ventilating burner, which, he said, is used in Buckingham Palace and in Windsor Castle.

In the course of the lecture, the following table of the constituents of five samples of gases taken in London was referred to:—

	Gas from Newcastle Cannel.	LONDON GASES.			
	A	B	C	D	E
Light carburetted hydrogen	51·20	35·25	35·28	41·50	40·60
Hydrogen	25·82	51·81	50·24	47·60	41·15
Carbonic oxide	7·85	8·95	7·40	7·32	8·02
Carbonic acid	·13	·00	1·28	·53	·29
Nitrogen	1·51	·38	1·80	trace	5·01
Oxygen	·43	·08	·44	·00	1·26
Hydro-carbons	13·06	3·53	3·56	3·05	3·67
	100·	100·	100·	100·	100·
Illuminating power of a 5-feet burner in 120-grain sperm candles	34·4	14·4	14·1	13·	11·5

The gas A is evidently that of the Western Company, manufactured from Ramsay's Newcastle cannel. E is doubtless a specimen of the genuine "four-shilling mixed," immortalized by our talented correspondent, "The Man in Pancras-lane," and containing about 6 per cent. of atmospheric air; but we have some doubts whether the quantity of carbonic oxide as well as the illuminating power be not exaggerated in all of them; the latter owing possibly to the want of due precautions against the influence of reflected light—a source of error which Dr. Letheby and others now provide against by the

adoption of the blackened cones on each side of the Bunsen disc, first suggested by Mr. Lewis Thompson.

The comparative cost of the light from different illuminating agents (the standard being 20 sperm candles of six to the pound) was stated to be as follows:—

Wax candles	*7s.*	*2½d.*
Spermaceti candles	6	8
Tallow candles	2	4
Sperm oil	1	10
Manchester gas	0	3
London cannel gas	0	2¼
London common gas	0	4½

The advantage, in a sanitary point of view, of well-purified coal gas, over all other materials for artificial illumination, is clearly established by the following table of the carbonic acid stated to be produced in 10 hours by the combustion of such quantities of the under-mentioned illuminating agents as are requisite to yield a light equal to 20 sperm candles consuming 120 grains per hour:—

Tallow	10·1	cubic feet
Wax, Spermaceti	8·3	,,
Sperm oil	6·4	,,
Common London gas	5·	,,
Manchester gas	4·	,,
London cannel gas	3·	,,
Hydro-carbon Boghead gas	2·6	,,
,, Lesmahago	2·3	,,

Journal of Gas-lighting, June 10, 1853.

NEW MODE OF GAS-HEATING.

A new mode of heating the Music Hall at Worcester is described by the local *Herald*. The Heating Apparatus consists of three brick cylinders placed in the basement under the hall, containing an arrangement of gas tubing, perforated so as to afford hundreds of jets of flame. From these cylinders only pure warm air is said to be given off, the residuum of combustion, viz. carbonic acid and aqueous vapour, being taken away in a separate tube, without, however, any waste of heat; that tube being inclosed in the one containing the purified warm air, to which its heat is imparted. The pure-air tube is conducted beneath the floor, which it traverses in the centre, having seven openings of perforated zinc, fitted with slides to admit or exclude the hot air. The apparatus, adds the *Herald*, consumes only 520 cubic feet per hour, and an hour's supply of hot air is sufficient for an evening's concert, while it also insures complete safety. Mr. Richards, of the local gas-works, arranged the apparatus.—*Builder*, No. 531.

PORTABLE GAS APPARATUS.

Messrs. Stratton & Brother, of Philadelphia, have patented a compact apparatus for the manufacture of Gas from Resin, or other similar hydro-carbon; in the construction of which the stove, retort, and cooler, are so arranged as to be portable in every sense of the trem, by merely disconnecting the supply pipe, which is then stopped

by a plug or screw cap. The stove itself somewhat resembles a ship's cooking apparatus; the furnace and ash-pit occupy the lower portion, over which the retort is so placed that the projecting ends counterbalance the weight of the centre, preventing any sinking in the middle, or injury from expansion and contraction. On the top is the receptacle for the resin, in which it is melted, and is supplied to the retort by a valve opening into a vertical main, from which the supply is regulated. The gas outlet pipe is carried through a tank of cold water, and to it the tubes leading to the burners are attached. The whole stands on a solid platform, and every part of the apparatus is ingeniously arranged for cleansing and repairs when necessary.

GAS-HEATING APPARATUS.

Mr. Cuthill, of Camberwell, has exhibited to the Horticultural Society a Gas-Heating contrivance, which he has invented. It consists of a hemispherical cast-iron chamber, to the top of which is attached a pipe, which, after being led along the house to be warmed, is returned, and discharges itself outside. The chamber is intended to be built in the end wall, with as much of the dome inside as possible, leaving an opening outside (to which the door is affixed) for introducing the gas-burner which is to heat the apparatus. It was stated that if it is possible (which Mr. Cuthill is confident it is) to render the joints sufficiently tight to prevent leakage, this invention might be found useful, near places having gas laid on, in heating window gardens and small houses, which it is very difficult otherwise to warm without over-heating. Mr. Cuthill stated that a contrivance of this description in a greenhouse 12 feet by 8 feet has been found to work satisfactorily with a gentleman in the Old Kent Road, and that a heat of 45° could be maintained with ease when there were 12° of frost outside.

MILNE'S NEW GAS-STOVE.

At the Royal Scottish Society of Arts has been described a new Gas-stove for economically heating ornamental tools and glue; specially adapted for dressing and fancy leather case makers; the invention of Mr. John Kolbe Milne. Mr. Milne stated that the stove consists of an oblong box of black sheet iron, about 12 inches long, 9 inches high, and 6 inches broad, with perpendicular sides and back, and with the front sloping outwards like the side of a pyramid, the stove being thus broadest at the bottom; there are four short legs or feet which drop into holes in an iron plate, which plate only is screwed to the bench. In the top of the stove two holes are cut to let in the glue-pots; in the front of the stove is a broad, low doorway, about $6\frac{1}{4}$ by 3 inches, just within which stands the gas-box. The gas-box has a heating surface 6 inches long by 1 inch broad; the gas rises through wire-gauze sprinkled with gravel, and is burned as in the stoves used by bookbinders' finishers, with a blue smokeless flame. Whether ornamental tools are being heated or not, the air within the stove is maintained at about 150°, which is the best heat for both dissolving and using glue; a zinc pipe, leading away to a chimney, is attached

to the back of the stove, causing the heated air to circulate round the glue-pots, and carrying off the unhealthy fumes. One stove gives ample accommodation to two men, but is not intended for more; the object being to get the use of fire without having to move one step towards it, not even to turn round. The consumption of gas for one stove does not exceed 12 feet in a day of 10 hours, costing at the rate of 5*s.* 10*d.* per 1000 feet—$\frac{7}{8}$ths of a penny, or within a halfpenny a-day for each man. The glue in the pots cannot possibly burn, nor can the ornamental tools be injured by smoke or overheating.

WARMING, VENTILATING, AND COOKING BY GAS.

A PAPER by Mr. Rutter, a man of great practical experience as a gas engineer, and author of a useful little pamphlet on "Gas-lighting in Private Dwellings," has been read at the Society of Arts, and is reported at some length in the threepenny *Journal of the Society of Arts* of Feb. 18th. Mr. Rutter described the usual gas-stoves, and reprobated their use without proper ventilation by flues, long enough—say at least half a dozen feet, but as much longer as convenient or necessary in order to distribute the heat before quitting the apartment; and then, if possible, to be inserted into a chimney with a good draught. As the heat in such a flue or tube would be but moderate in intensity, perhaps, we may here remark, it might even be carried round a room in such a way as to be no eyesore, but rather to appear as a sort of skifting, though detached entirely from the wall plaster by brackets; or, as suggested after the paper was read, it might be compactly coiled beside or around the stove itself. Should the room have no chimney, or a bad one, it ought to be carried to another, and "in its course," said the reader, "whether rising above the room or descending below it, special care must be taken to incline the tube downwards towards the chimney it is to enter. This is to ensure the perfect drainage of the condensed vapour. A fall of about 1 inch in every 10 will be sufficient." A discussion followed, in which the advantages of gas for heating and cooking seemed to be pretty generally admitted. We think, however, that the propriety of ventilating gas-burners, especially in small apartments, which in fact they not only light, but also heat, and that sometimes offensively, from mere want of ventilation, ought to have been more insisted on than it was.

THE CENTRAL GAS CONSUMERS' WORKS.

THE extensive works which have recently been completed at Bow Common for the Central Gas Consumers' Association are remarkable for the magnitude and economy of their productive power. They are computed to be capable of producing 800,000,000 of cubic feet of gas per annum. The retorts employed are placed in two rows of arches, an upper one and a lower. Each of the upper arches contains six clay retorts, and each of the lower arches seven iron ones. The produce of each retort per day is set down at 8000 cubic feet. These retorts, which have a principal section of 8 feet by 19, are heated by fires three or four times smaller than those commonly in use, their dimensions being 7 inches in width by 28 in length. To assist and

economize the combustion in these furnaces, the coal-tar produced by the distillation is employed as fuel, after being in the first instance conducted into convenient tanks for temporary storing. This practice is productive of an economy always desirable, and the atmosphere of the works is maintained in a state of greater purity.

There are four large gas-holders, which can jointly store nearly 2,000,000 cubic feet, and the mains have a total length of nearly seven miles. The total cost of these large works,—including a sum of about £30,000 incurred in law expenses, whilst obtaining the necessary Parliamentary powers,—has only amounted to £210,000; a cost, having regard to the magnitude of the works, unparalleled in its smallness in the history of the gas manufacture.

ROASTING BY GAS AT THE ROYAL NAVAL SCHOOL, GREENWICH HOSPITAL.

Two interesting trials have taken place at the above establishment, with an apparatus manufactured by Messrs. Smith and Philips, patentees, of Skinner-street, Snowhill, under the superintendence of M. Soyer, which, in their results, finally determine the question on the merits and economy of Roasting by Gas. The result of the first trial was, that 36 legs of mutton, weighing 288 lbs., were roasted at a cost of 1*s.* 2*d.* In order to arrive at more positive results in regard to its economy, a second trial was deemed requisite, when equal weights of mutton were cooked—23 joints, weighing 184 lbs., were roasted by gas at a cost of 10½*d.*, with gas supplied at 4*s.* per thousand feet; when cooked, the above weight of meat was found to weigh 146 lbs., dripping 19 lbs., of gravy or ozmazone, 2¾ lbs.—thus showing the actual loss to be 8¾ lbs. 23 joints of mutton, weighing 184 lbs., were cooked in the usual way as adopted at the institution, namely, in one of Count Romford's ovens, hitherto considered the most economical way of roasting. When taken out they were found to weigh 132 lbs.; dripping, 18 lbs.; *gravy none;* thus showing a loss of 34 lbs. The coke consumed by the oven weighed 102 lbs., coals 30 lbs., thus proving the great economy of gas over the oven by a saving of 13 lbs. of meat, 1 lb. of dripping, 2¾ lbs. of gravy, the value of which saving is as follows:—meat, at 6*d.* per lb., 6*s.* 6*d.*; dripping, at 5*d.* per lb., 5*d.*; and gravy, at 1*s.* 6*d.* per lb. 4*s.* 1¼*d.*; making a total of 11*s.* 0¼*d.*—*Sun.*

GAS AND STEAM BOILER.

Mr. H. M. Lefroy, R.N., has a proposed plan of constructing a Boiler and Furnaces in which all the gaseous products of the combustion of the fuel will be discharged into the bottom of the boiler; and thence pass, rising through the water (in which all the impurities they may carry from the furnace will be deposited), saturated with steam, through the steam chest into the steam cylinders; the molecules of the gases serving as the conductors of the caloric into the water, instead of radiating it, as at present, through the plates and tubes of the boiler into the same body.

The advantages attributed to this form of boiler and furnaces are:

1st. A great economy of fuel, resulting in two ways; namely, in an absolutely greater quantity of caloric being generated from a given quantity of fuel, and in the saving of that portion of it which at present passes up the funnel in combination with the gases, both in the latent and sensible form.

2ndly. A saving in the cost of the apparatus, due to a reduction of its weight and size, and to its increased durability. The size will be diminished from the smaller quantity of coal to be burnt, and from the greater rapidity of its combustion, which probably will vary with some power of the density of the supporter of combustion; and the durability will be much increased from no part whatever of the boiler being exposed to the direct action of the furnaces: and since probably nine-tenths of the whole elastic bodies which pass through the cylinders will be steam, condensation will still be applicable with advantage, on the condition of using a larger air-pump with the condenser than at present is necessary.

A careful analytical investigation, made by the author and printed as an appendix to Mr. A. Gordon's tract on the Fumific Propeller, gives 2630·767 lbs. raised one foot, as the measure of the elastic force of the gases into which 1 lb. anthracite coal is decomposed by combustion, after deducting the equivalent of the air pumped in to sustain that combustion, on the assumption that the whole caloric developed by the combustion is retained by the gases. Now, although, as has been stated above, in the proposed system far the larger part of the caloric will be expended in the generation of steam, the gases simply conveying it into the water; still, since the volume of these gases is more than three times that of the air which is necessary to their generation under the same temperature and pressure, and all the caloric developed must be either retained by the gases, or taken up by the water, in either case contributing to the total elastic force generated and utilized, a considerable increase of power over that now realized may confidently be expected.

The stoke pipes of the furnaces are each intersected by a sliding water-filled door, communicating with the boiler by two small pipes working in stuffing-boxes. These doors will be so fitted to the chamber in which they slide, as to prevent the escape of any of the gases from the furnace into the air. In fact the greater the excess of the gaseous pressure in the furnace over that of the atmosphere without, the more tightly will the sliding door be jammed against the part of the boiler on which it rests. Each of the furnaces is capable of being stoked separately and independently of the others; and during this operation, combustion in that furnace will be suspended by the supply of oxygen being cut off, whilst the other furnaces continue in full operation.

GAS FROM WOOD OR PEAT.

Mr. John Ayliffe, jun., of Moscow, has communicated to the *Mechanics' Magazine* a description of his apparatus for making Gas from Wood or Peat, which he states is much cheaper than that from coals, not injurious to health, the retorts last much longer, six times

the quantity of gas can be made in the same time, and as it requires no purifying, it will prove of much importance where wood or turf is plentiful, and coals and lime scarce. The retorts are fixed in the usual manner, the ascending pipes from them dipping into the hydraulic main; but instead of being carried off at one end to the purifiers, a pipe passes downwards from it into a hollow sphere fixed in the bed of the furnace, and kept at a temperature indicated by a dark red heat. The gas passes through this ball intensely heated into a naphtha chamber in the basement of the works, by means of a pipe dipping into a cup in the centre, the outer casing serving as a receiving-box for the refuse. There is also another box, in which is an inverted bell-shaped receiver, in which the gas is well washed with naphtha, or coal-tar, and six per cent. of turpentine, from whence it is passed to the condenser and stored for use, requiring no purification.

CANDLE MAKING.

Mr. George Fergusson Wilson, of Belmont, Vauxhall, has patented certain Improvements in treating certain fatty bodies consisting of acting on "Bornean vegetable tallow," (which is a vegetable material recently imported from Borneo, resembling tallow,) and on "nutmeg butter," by powerful acids, and in distilling such matter after being acted on by acids; and thereby producing valuable products suitable for the Manufacture of Candles.

The acid process adopted by the patentee is conducted in the following manner:—The Bornean tallow or nutmeg butter is placed in a copper vessel or a wooden vessel lined with sheet lead, and gradually heated up to 350 Fahrenheit; after this, concentrated sulphuric acid is added in the proportion of 720 lbs. to every 6 tons, and at the end of about three hours, the tallow is pumped into a vessel containing acidulated water, and agitated by free steam passing through it for about two hours, when it is allowed to repose: or, the tallow is heated only to 120 Fahrenheit, and a ton and a half of concentrated acid is run very slowly into the vessel, stirring the while, and then keeping the mixture stirred for about twelve hours, after which hot water equal to half the bulk of the fatty material is added, and the whole well stirred up and allowed to repose for four hours.

After either of these processes, the tallow or butter is distilled in a still from which the atmosphere is excluded, which is best effected by means of steam, vapour, or other product not containing oxygen. The patentee prefers, however, to use highly-heated steam, introduced in numerous jets or streams below the fatty material in the still, and thus to cause the distillation and exclusion of air to be effected by the same means, assisting the former process by the aid of a fire under the still. The distilled products are received in a condenser, and when condensed may be used alone, or be mixed with other candle-making materials, for making candles and night-lights of the better class; or the process of distillation may be altogether dispensed with in making candles and night-lights of inferior descriptions.

Mr. George Gwynne, of Hyde-park-square, and Mr. G. F. Wilson, have also patented the following:—

The patentees observe that it has been found that fatty and oily matters which have been treated or operated on with nitrous, hyponitrous, or allied acids, do not burn well, in consequence, they believe, of a combination or intimate mixing of the acids in the fats or oils. And their invention consists in improving fats and oils which have been so treated by causing them to be acted on by a salt of a weaker acid, such as acetate of ammonia or others.

The process of hardening fatty matters by nitrous fumes, was described in the specification of a former patent to Messrs. Gwynne and Wilson, Dec. 8, 1842, and is still conducted much in the same manner, until the distinct evolution of nitrous fumes takes place, when the boiling is checked by admitting cold water, and the acetate of ammonia is added in the proportion of 4 lbs. to every cwt. of fatty matters. After this the mixture is well stirred, and allowed to repose for four hours, when the supernatant fatty matter is to be drawn off and filtered in a warm room, and is then ready to be made into candles and night-lights.

Other salts of weaker acids may also be similarly employed; but if liable to act injuriously in the burning of the fatty matters, as is the case with acetate of soda, a subsequent boiling of the mixture with acidulated water and free steam should be resorted to.

PREVENTION OF SMOKE NUISANCE.

Mr. A. Fraser, jun., has described to the Society of Arts the result of his attempts to remove the Smoke Nuisance from the Brewery of Messrs. Truman, Hanbury, and Co. In 1847 the writer's attention was first drawn to Juckes' patent furnace, which consists of a strong cast-iron frame of the full width of the furnace, and about three feet longer. The fire-bars were all connected together, forming, when complete, an endless chain, and were made to revolve round a drum, placed at each end of the frame. The front of the frame was provided with a hopper, in which the fuel was placed, and a furnace-door, which opened vertically with a worm and pinion. The height to which this door was raised by the stoker regulated the supply of coal, which was carried into the fire by the gradual motion of the bars. The whole machine was placed upon wheels, to facilitate its removal for repairs to the boiler, brickwork, or furnace. The speed of the furnace-bars was determined by the draught. It varied from one inch and a half to three inches per minute, the object being to keep the whole of the bars covered with fuel, with a small accumulation of fire at the bridge. The bridge was suspended by a pipe three inches or four inches in diameter, fixed about one inch above the level of the bars; this allows the clinkers formed to fall into the ash-pit, but would not allow the fire to pass. A small stream of water must be supplied to the pipe or stop, or it would soon be destroyed. All the air admitted to the fire to support combustion was made to pass through the furnace bars. The consent of Messrs. Truman, Hanbury, Buxton, & Co. was obtained to the application of this plan to one of

their engine boilers—a cylindrical boiler, with two tubes—driving a forty-horse engine. Its success led to its application to a second boiler of the same form. In the same year the probability of its success under a brewing copper was discussed. There was no doubt, from the former experiments, as to its capabilities for raising steam or for evaporation; but with a brewing copper, provision had to be made for a process in the manufacture almost peculiar to it. The contents of the copper had to be turned out several times in the course of a brewing, rendering it necessary to "bank up" the fire thoroughly, to protect the bottom of the copper, until refilled with wort or water. It was feared that the machinery would interfere with this being done effectually; it was tried, and with the same success as with the steam boilers. It was found that a fire of fifty feet or sixty feet area could be worked for any number of hours without the slightest appearance of smoke from the chimney-shaft; but the process of "banking up," before referred to, required the whole principle of the machine to be put in abeyance, during which time smoke escapes from the shaft, and sometimes in large quantities, and no plan has been discovered for its prevention. The total cost of the fourteen furnaces, including brickwork, has been about £3000. The consumption of coals in the establishment is about 6000 tons per annum. The saving in the coal account, since the introduction of the patent to July 1, 1853, was £8338, from which was to be deducted for casualties and sundries, say £350. The above economy has not arisen from less weight of coal consumed, but owing to the screenings or dust of coal only being required for the furnaces. In the furnaces erected at the brewery, a considerable reduction has been made in the area of all the new furnaces, varying from twenty to thirty per cent., with an increase of water or wort evaporated of fifteen per cent. in one of the large brewing coppers. It would appear at first sight that the wear and tear of a machine, apparently so complicated, must exceed the expense of the common fixed bars. This, however, had not been found to be the case, and it need not be so if ordinary care was given to the machine.

CLEARING TOWNS FROM THE SMOKE OF DOMESTIC FIRES.

Although Lord Palmerston's Act in a great measure remedies the nuisance of smoke in manufactories, yet it is too well known that the atmosphere is contaminated by the quantity of smoke which is generated in towns by fuel consumed for domestic purposes. To obviate this evil, Mr. Julius Jeffreys, F.R.S., proposes, as it is impossible to consume the smoke of coal burnt in open domestic fires, that non-fuliginous matter shall be used as fuel. He states that charcoal, on account of its expense, is out of the question; that anthracite and common coke, from which it is possible to select a cheap and smokeless fuel, are not sufficiently combustible for use in common grates, it being both difficult to ignite and keep alight when applied to domestic purposes. It has, however, occurred to him that gas-coke might probably be brought into a state of vivid combustion when urged by jets of gas heating air in flowing to it, and that when

the coke was alight the gas required to maintain its combustion might be very small, while the coke would give out so much larger a proportion of its caloric, as radiant heat, than coal does, that it is possible the cost of the coal and gas united might not exceed that of a coal fire, having equal effect. In pursuance of this idea, jets of gas were conveyed into the bottom, and horizontally, in front of an ordinary parlour grate, which was then filled with gas-coke. This trial was found satisfactory. After a few re-adjustments of the gas-jets, a result was obtained surpassing that anticipated, and established the fact, that by the use of coke at £1 per ton, and gas at 4*s*. per 1000 cubic feet (the current prices of those articles), a greater heating effect may be produced than by an equal outlay on coal, while the advantages over a coal fire are, that an end would be put to the smoke of towns, the atmosphere would be clearer, there would be an end of smoky chimneys, the body would be kept cleaner, goods, decoration, and furniture preserved from injury. No wood is required to be used; the coke being placed in the grate, a person at any time could light his own fire by turning on the gas-jets; so long as the gas is allowed to flow, it may be lowered to the smallest glow, or soon raised to a pitch of brilliancy and power exceeding that of any coal fire; all useless consumption will be avoided; for culinary purposes it is equally applicable, and can be brought immediately into action, while coal requires to be half burnt before it is free from black and smoking points, and properly reddened. Half-a-dozen trifling jets of gas issuing from an iron tube, with lateral perforations, and commanded by a cock, is all that is required for a poor man's fire. The gas and coke need not at most exceed 1d. each daily. The plan is not the subject of a patent; all gas-fitters are, therefore, at liberty to use it: but as the inventor will be happy to give all information, he trusts due attention will be paid to the manner of adapting it for grates.—*Mining Journal.*

PATENT SMOKELESS FURNACE.

MR. JOHN LEE STEVENS has patented a "Smokeless Furnace," which consists of the very simple arrangement of receiving the hot cinders from the fire-box in a grate underneath, where they are turned to account in heating a current of air, and this heated current passing into the furnace completely prevents the generation of smoke. This arrangement is applicable to all furnaces, striking at the root of the smoke nuisance instead of curing it. Mr. Stevens's explanation of the invention is, that in the combination of two sets of fixed fire-bars, one above the other, the first being fed by the scoria and cinders voided from the second or upper set, with a calorific plate, the current of air entering at the lower part of the furnace passes through two strata of fire and then between the calorific plate (faced with fire-bricks) and the bridge, and is thus so intensely heated as continuously to produce the entire combustion of the gaseous products of the fuel, without the formation of smoke. The patentee states that it is practically ascertained that the fire-bars are not, as had been previously apprehended, liable to more destruction in this than in ordinary fur-

naces; the invention also increases the draught, uniformly distributes the heat, and keeps up the steam in boilers of whatever form; and, as the *Mining Journal* explains, the quantity of oxygen being regulated by the actual demand, is proportioned to the intensity of combustion—the fiercer the fire the greater the supply of oxygen—the more rapid the velocity with which the current of air rushes into the furnace. The necessity for an adjusting apparatus, always dependent on the uncertain attention of the fireman, is thus obviated. The saving of fuel consequent upon the perfect combustion of gases in this furnace is stated to range from 15 per cent. with Welsh coals, up to 25 per cent. with north country or the Midland counties coals, or patent fuel; 20 per cent. being the average saving.

MANUFACTURE OF PAPER.

MR. W. STONES, of Queenhithe, has read to the Society of Arts a communication on the "Materials and Machinery employed in the Manufacture of Paper." After alluding to the different substances upon which the ancients were accustomed to record their thoughts, the author proceeded to trace the history of the manufacture of paper from pulp, said to have been invented in China about the commencement of the Christian era, from whence it was carried to Mecca in the beginning of the eighth century, and thence by the Arabs to Spain in the end of the ninth or beginning of the tenth century. The first paper-mill in Germany was established at Nuremberg, in 1390. In our own country the earliest trace of the manufacture occurred in a book printed by Caxton about the year 1470. The materials employed in the manufacture came next under consideration; linen, or materials made of flax, either in the state of new pieces or old fabrics, was particularly valuable for the strength which it imparted to the paper. Cotton was too valuable in its state as imported, to be used in this manufacture, and was generally obtained from old white or printed goods. Flax and cotton waste, also used very largely, were the portions of the raw materials not available for being made up into woven fabrics. Hemp, or rope in the untarred state, was a very valuable material; when tarred it was used for brown paper principally. Specimens of paper from the plantain were exhibited, as also of wood; and it was observed that any fibrous vegetable substance, as the inner bark of trees, the stalks of the nettle, the tendrils of the vine, the bine of the hop, might be used, but that up to a very recent period no material had been found to answer so well as linen, hempen, or cotton rags. Woollen cloth or silk could not be beaten into a suitable pulp, wool particularly giving a hairy texture to the surface. Lately, however, straw had been made available in the manufacture of paper; and the specimens exhibited showed that ere long it would, if it had not already, become a formidable rival to the old-established materials. The operations of cutting the rags into shreds, their subsequent dusting in machines, and the boiling in an alkaline ley, for the purpose of cleansing the materials, were described. The rags were then subjected to the further process of comminution on the engine, which was supplied with a constant stream of water, so that

by continual revolutions the rags were thoroughly washed. After bleaching, which was effected with chlorine, the material was subjected to another grinding until finally reduced to fine pulp. The process of making by hand was briefly described. The pulp was allowed to flow into a vessel of stone, and kept moderately warm by means of a steam pipe, and continually in motion by a wooden agitator. From this vessel the maker collected on a frame, covered with wire gauze, the desired quantity of pulp, and by a gentle shaking motion compacted the material into paper; the water was expressed, the paper hung up to dry, after which it was sized by saturation, the superfluous size being pressed out, and the paper parted and slowly dried, by which the size thoroughly penetrated the paper. The mode of making paper by machinery was next described, and the passage of the pulp through the knotter or strainer, on to the continuous wire, to the continuous felt, and thence on to the drying cylinders, was explained. It was stated that Fourdrinier's horizontal cylinder machine was the one most generally used in this country. The sheets were then sorted, folded, and packed in reams, weighed by the revenue officer, and charged with a duty of three-halfpence a pound and five per cent. It appeared that at the present time there are about 304 paper-mills at work in England, 48 in Scotland, and 28 in Ireland. The duty amounted to upwards of 925,000*l.*, so that the annual value of paper manufactured in this country could not be less than 3,700,000*l.*, the average value of paper being estimated at sixpence per pound.

BENIOWSKI'S PATENT PRINTING MACHINERY.

By these new modes of "setting the types," any man, woman, or child, who is acquainted with the common alphabet, it is stated, may become a useful and correct compositor with only a few days' previous instruction; and by other inventions contained in these patents, the mechanical toil and irksomeness of composing are greatly diminished, while the production is increased fivefold. We now proceed to enumerate in general terms the nature of the improvements, as exhibited at the offices in Waterloo-place:—

First. We have types invented for the purpose of enabling any person to set up matter in metal for the press without the necessity of having recourse to professional compositors. On the feet and sides of these types are letters by means of which any man can compose as easily as those trained for the purpose; and any child can distribute the types, not only of the English, but also those of foreign languages. A lady set to work to compose, and the time arranged to be given was three minutes by a sand-glass and a repeater. The matter taken was from the centre of a column of a newspaper. The three minutes having expired, the lady had set up five lines and a half of solid printing. Mr. Douglas Jerrold took the metal in his hand and read therefrom, and announced that there were only two literal errors in the five and a half lines. Professor Ansted states that on one occasion when he visited Major Beniowski's establishment in Bow-street, he saw a person composing without any apparent difficulty upwards of 800 letters in ten minutes, with only two errors! This is, he believes, four or five times as fast as is usual amongst good compositors. Again, the task of correcting can be easily performed by anybody, and especially so by the author. Secondly, there are the "logotypes," the usefulness of which we believe has never been doubted. We are assured that by means of logotypes the *Times* newspaper was, during the first years of its foundation,

composed about four times quicker than it is at the present time. But this advantage, it is admitted, was far outbalanced by certain expenses and other inconveniences which the present inventor has, by very simple means, entirely removed; and it is said that in the composing of an ordinary sized paper, £2000 at least may be saved per annum.

Secondly. No machinery whatever for composing is required: any person of ordinary capacity, with a few months' instruction, can pick and set up into lines and pages from 5000 to 7000 types per hour with little chance of an error.

Thirdly. There are cases designated the "Authoriton," composed of several thousand compartments, and capable of containing from 100,000 to 200,000 types, occupying no more room than the usual ones.

Fourthly. Simultaneous Double Composing.—This is an absolute novelty. Two compositions of any given copy are made simultaneously in about one-and-a-half of the time required for a single composition.

Fifthly. An apparatus by means of which an unlimited number of spaces are picked up from pie and distributed.

Sixthly. A Printing Machine, having the following novel features:—The types are imposed on the interior surface of a cylinder, and cannot therefore fall out by their own gravity, nor can they be driven off by the centrifrugal force, be the angular and the perimetral velocity ever so great. The feeding and receiving boards, the distributing, inking, and impression rollers, like all the other organs of this machine, are in the interior of a cylinder, and, therefore, the whole occupies but one-third of the space it would otherwise require. The distances between the feeding and receiving boards are reduced to a few inches. The receiving and depositing of the printed sheets is performed automatically, and therefore the number of attendants is reduced in proportion. This machine is simple in construction; but its productiveness may be increased to an unprecedented extent. A machine constructed for the purpose of throwing off about 20,000 impressions per hour of a paper the largest size in existence, would occupy no more room than a common four-feeder. Such machinery, combined with a double composition, would produce 40,000 impressions per hour.

Seventhly. Inking-rollers, permanently elastic, not subject to atmospheric influences, and which may be driven with any velocity. They are filled with compressed air, and those in use were exposed during a period of upwards of twelve months to dry and wet weather, and also to temperatures varying from summer heat to below zero, without ever wanting more than a few minutes to make them dry. R. Greene, Esq., M.D., in his report on machinery generally, observes—"The inflated India-rubber rollers are absolute perfection. No other substance in nature possesses the perfect and permanent elasticity of vulcanized India-rubber and compressed air; and being formed without a seam, their durability appear to be almost without bounds."

Eighthly. There is a mould for casting types in general, and especially the newly-invented type, which is much more simple in construction, and about 50 per cent. cheaper than those in present use.

The ninth and last feature in these inventions is that of printing for the blind, the cost of which will be reduced, says the prospectus, from thousands to comparatively nothing.

NATURAL PRINTING PROCESS (NATURSELBSTDRUCK).

UNDER this term Louis Auer, of the Imperial Printing-office at Vienna, has patented a process invented by himself in conjunction with Mr. Andrew Worring, overseer of the same establishment, "for creating by means of the original itself, in a swift and simple manner, plates for printing copies of plants, materials, lace, embroideries, originals or copies, containing the most delicate profundities or elevations not to be detected by the human eye," &c.

A pamphlet giving a description of this discovery, and a series of specimens, have reached us. The examples consist of an impression from a fossil fish, from agates, the leaves of trees, several plants,

mosses, algæ, and the wing of a bat. These are all printed in the natural colour of the objects they represent; and it is difficult to conceive anything more real than these productions. The general character of the process is told in the following pithy manner by Louis Auer, in the introductory paragraphs of his pamphlet:—"*Query?* How can, in a few seconds, and almost without cost, a plate for printing be obtained from any original, bearing a striking resemblance to it in every particular, without the aid of an engraver, designer, &c.? *Solution.*—If the original be a plant, a flower, or an insect, a texture, or, in short, any lifeless object whatever, it is passed between a copper plate and a lead plate, through two rollers that are closely screwed together. The original, by means of the pressure, leaves its image impressed with all its peculiar delicacies—with its whole surface, as it were—on the lead plate. If the colours are applied to this stamped lead plate, as in printing a copper plate, a copy in the most varying colours, bearing a most striking resemblance to the original, is obtained by means of *one single* impression of each plate. If a great number of copies are required, which the lead-form, on account of its softness, is not capable of furnishing, it is stereotyped, in case of being printed at a typographical press, or galvanized in case of being worked at a copperplate press, as many times as necessary, and the impressions are taken from the stereotyped or galvanized plate, instead of from the lead plate. When a copy of a unique object, which cannot be subjected to pressure, is to be made, the original must be covered with dissolved gutta percha; which form of gutta percha, when removed from the original, is covered with a solution of silver, to render it available for a matrix for galvanic multiplication." This process is also applicable to the purpose of obtaining impressions of fossils, or of the structure of an agate or other stone. In all the varieties of agate, the various layers have different degrees of hardness; therefore, if we take a section of an agate, and expose it to the action of fluoric acid, some parts are corroded, and others not. If ink is at once applied, very beautiful impressions can be at once obtained; but for printing any number, electrotype copies are obtained. These will have precisely the character of an etched plate, and are printed from in the ordinary manner. The siliceous portions of fossil, and the stone in which they are embedded, may, in like manner, be acted upon by acid; and from these either stereotyped or electrotyped copies are obtained for printing form. It is not a little singular that the workers in German silver and Britannia metal, at Birmingham, have for some time been in the habit of ornamenting the surfaces of these metals by placing a piece of lace, no matter how delicate, between two plates, and passing these between rollers. In this way every fibre is most faithfully impressed upon the metal. We are not aware, however, that any attempts to print from these impressions have yet been made at Birmingham. The value set on the invention by the author, may be judged of by the following paragraph:—"Russia has given us Jacobi's application of the Galvano-

plastik, in the year 1837, and France the Daguerrotypy for general use, in the year 1839; Austria has now furnished a worthy pendant to these two inventions."—*Athenæum.*

STATHER'S PATENT SURFACE-PRINTING MACHINERY.

THE specification of this patent describes several valuable improvements in the art of Block or Surface Printing, as novel in design as they are elegant in effect and simple in contrivance. The first of these is a method of producing the blocks or forms for printing from, with the letters, figures, or devices to be represented left plain, the surrounding portions being those which are printed; the second is a mode of printing upon paper, cloth, or other articles, by means of a flat plate, upon the surface of which the intended letters, figures, or devices, are first printed in an inverted manner, and in one or several colours, and from which they are then transferred to the surface intended to be printed, on which, of course, they will appear in their natural position; and the third is an analogous method of obtaining impressions of figures, letters, or devices, in one or several colours, on paper, cloth, or other articles, by first printing the same in an inverted manner upon the surface of a cylinder or roller, by means of several small rollers working in conjunction therewith, and then transferring the impressions from the cylinder to the surface of the paper, cloth, or article intended to be printed. For details of the machinery, see *Mechanics' Magazine*, No. 1574.

ANASTATIC PRINTING.

A PAMPHLET has been issued by Mr. C. J. Jordan, of Lansdowne-terrace, Caledonian-road, containing a practical treatise on this interesting subject, with minute details, which will enable any amateur or workman to make facsimiles of engravings, or other printed paper, old or new, at very small cost. Mr. Jordan is an original investigator, and his pamphlet contains the results of his own experiments, although some of them have been anticipated by others. He states that he has obtained anastatic reverses from prints upwards of a century old, by simply operating on them in the way he has indicated.

CHROMATIC PHOTO-PRINTING TEXTILE FABRICS BY MR. R. SMITH.

THE author proposes to employ the chemical agency of light in dyeing or staining textile fabrics; the cloth, whether of wool, silk, flax, or cotton, being first steeped in a suitable solution, then dried in the dark, and subsequently exposed to the action of light, those parts which are to form the pattern being protected by pieces of darkened paper, or some other suitable material, attached to a plate of glass. When the desired effect is produced, the time for which varies from two to twenty minutes, according to the nature of the process, the fabric has to be removed, in order to undergo a fixing operation, whilst a fresh portion of it is exposed to light. This may easily be effected by the use of very simple mechanical arrangements, so that a number of photographic printing engines may be placed

side by side, and superintended by one person. From the trials which Mr. Smith has made, he believes that even the diffused light of a cloudy day will have power enough for the operation, though, of course, a longer time will be required for its perfection than on a bright and sunny day. In order to obtain a pale blue or white pattern upon a blue ground, Mr. Smith uses solutions of citrate or tartrate of iron, and ferrocyanide of potassium; steeping the cloth subsequently in a dilute solution of sulphuric acid. Browns and buffs are obtained by using a solution of bichromate of potash; the excess of salt in the parts not acted on by light being afterwards either washed out, leaving those portions white, or decomposed by a salt of lead which forms a yellow chromate of lead. By combining these two processes with the use of madder, logwood, and other dye stuffs, a great variety of tints may be obtained.

MAIN'S PRINTING MACHINE.

THE *Edinburgh Courant* gives the following account of the above new Printing Machine:—We were, a few days ago, invited to witness a new printing machine, patented by the inventor, Mr. Thomas Main, of London, formerly of Glasgow, and fitted up by him in the premises of Messrs. Thomas Nelson & Sons here. The machine is of remarkably simple construction, is worked at a small cost of labour, and is capable of great speed. Instead of a cylinder rotating on its axis, which is the principle of almost all printing machines, it has a cylinder of small diameter moving along a fixed table, or plane, on two-thirds of its surface, and immediately retracing its course. Its motions are regulated below by a wheel moving backwards and forwards upon a rack; and, in the return movement, it is elevated about a third of an inch from the types, to avoid a second pressure. The cylinder is 18 inches in diameter, and about 36 or 38 inches in length. The table for the form is 46 inches by 38. The sheet is placed upon the delivering-table, which is only a few inches higher than the level of the form, and is taken up by clasps in the hollow part of the cylinder, and wound round it as it moves along, receiving at the same moment the impression of the types, while, in the return movement, it is taken off upon another table. The ink is supplied very nearly in the usual manner. The whole labour required in working the machine is that of two boys, or one man and a boy; the one to "feed," and the other to "take out." The machine is capable of throwing off above 1000 impressions an hour, which, for a single cylinder, is an extraordinary speed. Altogether, the machine displays great ingenuity: it is admirable for its simplicity, and valuable for its dispatch.

AMERICAN PRINTING MACHINES.

THE first Printing Machine patented in the United States, is the Manifold Letter Writer, the object of which, as its name indicates, is to multiply the number of copies, by once writing the original; it consisted in the use of cams operated by a series of keys, whereby a horizontal lever, which held several pens or pencils placed

transversely across it, was moved in a direction to form letters upon the paper, a number of sheets corresponding to the number of pencils being clamped in suitable frames to hold them for the purpose. The process of writing by this machine was a very slow one, but when one copy was complete, a duplicate was also at hand. Another machine for accomplishing the same purpose was patented in 1850 by O. T. Eddy, of Boston, although the object was accomplished in a manner entirely different, and the alphabet a printed instead of a written one. This machine prints anything desired by the operator, in Roman letters, upon striking certain finger keys corresponding to the letters used—the operation of this machine, in the hands of a good performer, is about as rapid as that of House's Printing Telegraph, and nearly as rapid as the execution of writing by an ordinary penman. This machine is exceedingly expensive and quite complex, for which reason, probably, it has not been extensively used. Another machine has been patented, denominated the Phonetic Reporting Machine, designed to report speeches by working changes upon a small number of keys and type, to make a variety of letters or characters. A machine which shall fully accomplish this object is needed, as our reporters are seldom if ever able to get a full report, particularly from rapid speakers; if all the fingers and thumbs could be brought to aid in making characters, so that several characters could be made at the same time, greater speed might be obtained.—*Scientific American*, No. 39.

IMPROVEMENTS IN LITHOGRAPHY.

At the Imperial Printing-office at Vienna, by the use of a Self-acting Press driven by steam-power, as many as from 800 to 1000 impressions are taken from the stone within the hour. The inventor of this machine is C. Sigl, engineer, of Berlin and Vienna; and it is now successfully worked in England by Messrs. Maclure, Macdonald, & Co. The principal feature in the machine consists of a damping apparatus, simple and highly effective in its character. It is formed of a roller of hollow brass tube, pierced with numerous holes, and the surface of which is covered with such porous substances as sponge and soft leather. From a small trough on the top of the press a supply of water is kept up, by means of a small drip into the hollow cylinder, which, percolating through the outer covering, keeps the roller in a state of constant moisture. The inking apparatus, and the mode in which the stone travels and is brought in contact with the inking rollers, are the same as in Napier's Letter-press Machine. In order to obtain the impression, the stone passes under a brass scraper, attached to a cylinder, and which is acted upon by a small "catch," for the purpose of placing the paper smoothly. The stone is protected at the point of contact with the scraper by a leather tympan, and the paper upon which the impression is to be produced. The clean and sharp character of the impressions, and the finer portions of the work, rival the best descriptions of copper-plate engraving. The rate at which the copies are printed is about 700 per hour, large folio, the machine being driven comparatively slow. The

same amount of work would not be completed by the ordinary hand-press under four days. The only attendance required is a boy to feed and lay the impressions as they are delivered from the tapes, and one man, who, with a sponge, removes any ink which may remain on the edges of the stone after each impression. There is much less injury done to the stone by this mode of printing than arises from the somewhat rougher usage to which it is necessarily subjected when hand labour is employed.—*Morning Chronicle.*

REAPING MACHINERY.

Mr. A. Crosskill has read to the British Association a paper giving an historical account of the invention of Reaping Machines, from their use by the Romans and Gauls to the present time; with a view to show, that though reaping machines had not been brought prominently into notice before the Great Exhibition, such implements had long since been invented; and that the reaping machines of Messrs. M'Cormack and Hussey were constructed on the same principles as those which had been previously made in this country. Among other English inventions of reaping machines, he mentioned one by Mr. Smith, of Deanston, in 1812, which from time to time underwent improvements, and in 1835 it worked very successfully at the meeting of the Highland Agricultural Society. After that trial it was laid aside, as British farmers did not encourage, and, during the redundance of labour, did not want such machines. In 1822, Mr. Ogle, of Remington, near Alnwick, invented a Reaping Machine, which appears to have served as a model for Mr. M'Cormack, as his machine is in almost every particular the same as Mr. Ogle's,—a description of which was published in 1826. The same circumstances which prevented the adoption of Mr. Smith's reaping machine, also caused Mr. Ogle's to be laid aside; though in America, where labour is scarce, and the stalk of the corn more slender and dry, and therefore better adapted for the action of mechanical cutters, M'Cormack's reaper was soon in extensive demand. It was stated by Mr. Crosskill that about 2000 of M'Cormack's machines are anually sold in the United States, and that Hussey's is in nearly equal request in that country. The celebrity acquired by those machines in the Great Exhibition induced Mr. Bell, of Scotland, who had gained a prize in 1829 from the Highland Agricultural Society for a reaping machine, to bring his invention again into the field. In 1852 he contested with Mr. Hussey at the meeting of the Highland Society at Perth, and carried away the prize; and his reaping machine had proved victorious on several subsequent trials. It was to this invention that Mr. Crosskill particularly directed the attention of the Section. It differs in several essential points from those of M'Cormack and Hussey. In the first place, the machine is propelled before the horses, which are harnessed to a pole in the centre of the machine, and not on one side; in the next place, the cutters act like large double-edged scissors, which clip the corn as the machine is propelled into it; and a further advantage is, that it gathers the corn

after it is cut without requiring a man to rake it off,—which is necessary in the two other machines. The arrangement of the self-acting gatherer consists of an endless band of canvas, on to which the corn falls as it is cut, and it is then thrown on one side by a continuous motion of the canvas as the machine advances. With this machine, Mr. Crosskill stated, one acre and a half of corn per hour may be cut with two horses and one man to drive them.

In the discussion which ensued, Mr. Samuelson, the maker of M'Cormack's machines, admitted that Bell's reapers cut the corn better than M'Cormack's—and that the saving of the hard work required from a man in gathering the corn was an important advantage; but the draught of M'Cormack's machines, he said, is lighter, and they are less costly. It was stated that the cost of Mr. Bell's reaper is double that of Mr. M'Cormack's or Mr. Hussey's, the one being £40, the other £20. Mr. Crosskill stated, in reply to questions respecting the difficulties encountered in the use of reaping machines when the corn is laid, that there is no difficulty in cutting and gathering laid corn, if the machines meet it inclined towards them, so that it may fall on the gathering board as it is cut.—*Athenæum*, No. 1351.

MACHINES FOR TILLING LAND.

MR. B. SAMUELSON has read to the British Association a paper "On some recent Improvements in Machines for Tilling Land." After pointing out the disadvantages attending the use of the plough, which, whilst it loosens the surface, hardens the subsoil, and noticing various recent inventions for ploughing and digging, Mr. Samuelson described a Forking Machine, which he conceives will be a great improvement on the common plough. It is constructed on the principle of a light digging fork, the prongs of which are thin and are made of the best cast-steel. A number of these curved prongs radiate from a centre, and several of these wheels of spikes are fixed on a bar which turns freely as the machine is drawn along the ground. To regulate the depth that the prongs enter the ground, and to cover them altogether when the machine is not in action, there are broad wheels on each side, which may be lifted or lowered to the required height; so that when the prongs are not wanted the machine may run upon the peripheries of the wheels. To prevent the prongs from being clogged, scrapers are fixed on each side, which clear away the soil that adheres to the prongs as they are successively raised. The weight of one of these machines is 1 ton, the usual depth that the prongs enter the ground is 10 inches, and the width is 6 feet. Mr. Samuelson said that this machine does not invert the soil so completely as the plough; but that action is less required when the soil is so thoroughly loosened as it is by the prongs. The machine is drawn along the field by horses.

Mr. Crosskill, and other members, suggested improvements in the shape of the prongs, and in the action of the scrapers, and expressed gratification at seeing such a step made towards abolishing so rude an implement as the plough. Mr. Fairbairn said, we are now on

the eve of a new era in agriculture, and the time is arrived when machinery must be applied to agriculture on a large scale.—*Athenæum*, No. 1353.

THE CYCLOIDAL DIGGING MACHINE.

This machine is the invention of Mr. Wilson, of Newry, but is described as an adaptation of Crosskill's Cultivator. As exhibited in an experiment on Kennington-common, five strong horses were attached to a small wooden frame, about six feet square, the centre of which consisted of a series of five iron cylinders, each armed with 20 teeth of the consistence of an ordinary pick-axe, set in a position best calculated to enter the ground with the smallest amount of resistance. Cast-iron scrapers affixed to the rear of the machine were intended to receive the clod of earth from the teeth, and complete its friability; but early in the trial these scrapers yielded under the force they were subjected to, and the complete action of the machine, as designed by the inventor, was consequently not seen. The great objection to this, and all other implements of the same character hitherto introduced, arises from the irregularity with which the iron diggers enter the ground, and the impracticability of turning the upper soil over so as to destroy the grass or weeds growing upon the surface. The irregularity of depth produces a corresponding number of holes, into which all the drainage of the field necessarily discharges itself, and at these points seed sown would, as a matter of course, perish. The consequence of not effectually turning over the sod would be simply this, that after the first shower the grass or weeds shaken or scarified by the machine would spring up with increased fertility, and in a few days the surface of the ground would resume its original hardened state. The trial was not satisfactory.

MACHINERY FOR GRINDING CORN.

At the late meeting of the British Association, Mr. Crosskill described an improvement in the construction of Corn Mills, the invention of a working man named Barnett,—and consisting of an application of wire gauze inserted in cavities in the mill-stone, which serve the purposes of ventilating the corn during the process of grinding, and of liberating those portions of the flour which are sufficiently ground before reaching the peripheries of the stones. By this contrivance, Mr. Crosskill asserted that a much larger proportion of gluten is retained in the flour—consequently, there is much less waste; and the same quantity of wheat is capable of being converted into a larger quantity of food. The saving was stated to exceed 5 per cent.

HYDRAULIC MACHINES IN AGRICULTURE.

Spain, strange to say, appears to be leading the way to an obvious and important improvement in irrigation. The *Boletin Oficial de Toledo* gives the following account of the recent employment of an Hydraulic Machine there:—"We have seen in this city, for the first

time, the application of an hydraulic machine, constructed in Madrid, in the manufactory of Nicolas Grouselle & Co., outside the gate of Bilboa, destined to raise the waters of the Tagus for the irrigation of the lands which surround it. The results obtained ought to fix public attention and that of the authorities of the provinces in an extraordinary manner, from the importance which the establishment of these machines may give to our agriculture in all the points where their application should be possible, employing the force of water as the *motor*. The machine, which we have seen in action, has highly exceeded the expectations which we had conceived of it. Placed upon a dam, which had been broken and abandoned for some centuries, the engineer constructor has succeeded, with the insignificant fall of a foot and a half, in obtaining a moving power which raises 130 arrobas (25 lbs. each) of water per minute to the height of 30 feet, which is equal to what eight norias would produce, for which, working for twenty-four hours, it would require thirty horses." The general importance and utility of hydraulic machines of various kinds, in town as well as country, are not yet appreciated as they ought to be and will be.

FISH MANURE AS A SUBSTITUTE FOR GUANO.

In a paper read to the Society of Arts, by Mr. J. B. Lawes, it has been stated that a discussion has taken place on this subject before the Royal Dublin Society; from the Report of which we gather that large quantities of offal fish and fish offal, which at present are thrown into the sea, would be brought to shore, provided they could be sold on the spot at a price of from 30*s.* to £2 per ton. Mr. Pettitt's process consists in mixing sulphuric acid with the fish-material, and drying it. It appears that a Fish-Manure, prepared by such a process, although undoubtedly an excellent manure, is nevertheless widely different from *guano,* both as to the constituents which it supplies and the state of combination of those constituents. In guano we find large quantities of phosphate of lime (in a state of comminution in which it is more readily available than in most other manures); whilst, judging from the analysis by Professor Way, the product of Mr. Pettitt's process contains only a very small quantity of phosphate of lime. In guano, again, the whole of the nitrogen, or nearly so, exists, either in the form of ammonia or of other very readily active nitrogenous compounds, the products of the perfect chemical destruction, in their passage through the body of an animal, of those more stable nitrogenous compounds of which the bodies of the fish so largely consist. In the product of Mr. Pettitt's process, however, there can be but little of the salts of ammonia or the other compounds resulting from the digestion, assimilation, and retransformation of the substance of the fish when it has been used as food. In fact, the proposed fish-manure is *dried animal matter,* with but little chemical alteration; in which, therefore, a large proportion of the nitrogen will still exist in its original state of combination. However valuable, therefore, such a substance may be as a manure, it can certainly with no propriety be called a *guano.* The chemical effect of

the sulphuric acid on the animal matter, and its utility in the process, are, indeed, not very obvious. It would probably serve, on the one hand, somewhat as an antiseptic; and on the other, to retain the small quantity of ammonia which might still be formed.

Again, the sample of fish-manure analysed by Professor Way contained only about 5 per cent. of water. But as the quantity of water in fresh fish is not much less than 8 per cent., it is obvious that it would take from four to five tons of fresh fish to produce one ton of the manure in the condition of dryness as stated. If, therefore, we take the most favourable estimate which the statements at present made seem to justify, namely, that one ton of fish, or its offal, could be delivered on shore for 30*s.*, it would then appear that from £6 to £7 must be paid for the raw material only at the place of landing of one ton of manure: to which must be added the cost of sulphuric acid, of the drying, of labour of boys, transports, &c.

For these reasons, it will be very difficult to produce a manure of the kind in question which can be sold to the farmer at much less than the present price of Peruvian guano. It would seem, indeed, from calculation, that unless offal fish and fish-offal could be obtained at an almost nominal price, it would at present be almost impossible to establish a manufacture which could so compete with the manures now in the market as to hold out a prospect of success both to the producer and the consumer. And how far also a decline in the present supplies of natural guano, as well as a much reduced estimate of the cost of the fresh fish and offal might affect the result, is of course a further question.

NEW SOURCE OF SUPPLY OF GUANO.

Mr. James Caird states, in a letter to the *Times*, that an immense deposit of Guano has been discovered in the Indian Ocean, between Mauritius and Calcutta. Four samples have been brought home, two of which are of superior quality, resembling the guano of Saldanha Bay. The other two are comparatively inferior; but as the samples were taken from near the surface, it is considered that they are inferior to what may be found beneath. The discoverer traversed the island in various directions, and found guano everywhere. The island is twenty miles long by seven broad, and is thus forty times the size of Ichaboe.

TOWN CLOCK FOR BIRMINGHAM.

Among the recently projected plans for giving the inhabitants additional convenience, is that of a Public Clock, proposed to be placed in one of the most conspicuous parts of the town,—in all probability the top of New-street. Twenty designs were sent in, and from these the committee selected one, designed by Mr. Francis Whishaw. Having in view the further ornamentation of the town, as well as the public utility of the erection to be set up, Mr. Whishaw considered that a statue of some sort would best fulfil the first-named consideration, if it could be made subservient to the second or more utilitarian consideration; so he chose the subject of Hercules reliev-

ing Atlas for some time of his burden (see Virgil, Ovid's *Met.*, and Hesiod.) The figure of Hercules is 8 feet high, bearing on his shoulders a celestial globe (a four-faced clock to be illuminated at night), 5 feet in diameter,—the whole standing on a massive-looking pedestal 5 feet in height.

The clock-works (Shepherd's electric, as used at Greenwich Observatory, &c.) are to be placed within the pedestal, which is to be kept at all times at an uniform temperature by jets of gas within, in connexion with the pipe supplying gas for the globe; the shaft from the works to be carried up to the globe for the purpose of communicating motion to the hands inside the figure, which is intended to be cast in metal, and bronzed externally, as also the pedestal.

By the adoption of the electric clock, Greenwich (railway uniform) time may be accurately transmitted to Birmingham; and, moreover, all other clocks belonging to the corporation of the borough may be replaced simply by clock-faces—thus requiring attention only to the parent clock, which may be located in such case in a house in the centre of the field of horological operations. The time is not far distant when clock-power will be supplied to all the principal cities and towns of Europe as water and gas are at the present day.—*Builder*, No. 530.

WESTRUP'S PATENT CONICAL FLOUR-MILL.

For this invention patents are taken out in every country in which they can be granted, and applications are daily made from the Continent and the United States to have mills. Besides the Conical Flour-mills already erected in France, Belgium, Vienna, and Mexico, others will speedily be supplied to the Hanse Towns, Russia, Denmark, Sweden, and Switzerland. They may be seen in operation at Pavitt's, Wapping.

The following are the constructive details:—

"The old flat flour-mill ordinarily consists of a lower fixed circular stone, and an upper revolving one, each of about 4 ft. 6 in. in diameter. The wheat being introduced between an aperture, is drawn in, and ground between the revolving and the fixed *surfaces*. The average weight of these stones is about 14 cwt., and it is ordinarily found that the grinding surface presented is so extended as to render the delivery of the flour extremely slow and uncertain, notwithstanding the great velocity of the running stone, which is generally 120 revolutions per minute. The evil arising from this circumstance is, that the flour, finding only a partial escape, is triturated and re-triturated, to the great ultimate injury of the meal.

"Some idea of the power required to keep such massive machines in operation may be gathered from the fact, that a single pair of stones, 4 feet in diameter, require the power of a four-horse engine to maintain the needful speed. This enormous power becomes necessary, in consequence of the great weight of the 'top stone,' the rapid rate of revolution, and the very large amount of friction produced by the process of grinding so glutinous a substance as meal between such extended surfaces.

"These are the principal objections to the old flat mill system of grinding, which has been the universal one in use in all parts of the kingdom for a considerable time; the only variation in practice consisting of the motive power. Most commonly steam power is employed, but when the locality admits of its introduction, the cheaper and more uniformly certain agent, water, has been brought into action. In all other respects, the mechanical detail of the system has been uniformly the same.

"The 'conical' mill is intended to obviate these defects; and a very few remarks will suffice to show that its inventor has not only detected their causes, but

has brought into operation a most philosophic, and therefore successful, combination of grinding and separating agencies, by which these defects have disappeared to an extent which leaves little to be desired. The beneficial changes effected may be succinctly enumerated. First, the reduction of the weight of the running-stone from 14 cwt. to $1\frac{1}{2}$ cwt., by placing it beneath instead of upon the fixed one; secondly, the reduction of the size of the stones in the proportion of 3·34 to 1; and thirdly, the giving to the stones a new form—that of the frustum of a cone. The advantage of lessening the diameter and weight of a mass, of which the one is 4 cwt., and the other 14 cwt., will be apparent, when it is considered that its effective velocity is 120 revolutions per minute, and that this velocity must be sustained against the enormous friction of the grinding surfaces. The altered position of the running-stone admits of a much more delicate adjustment of the opposing surfaces, and gives to the miller an easy and effective control over the most important portion of his operation. The conical form facilitates the discharge of the flour, and obviates the clogging and overheating of the old practice. In addition to these advantages, by a judicious modification of the ordinary mode of dressing, or rather by a combination of the mill with the dressing machine, a perfect separation of the flour from the bran is effected at the moment the grist escapes from the stone. The bran still remains in the mill, and falls by its own gravity to a second pair of stones in all respects resembling those already described.

"Both pairs of stones are mounted upon the same spindle, and of course impelled by the same gearing. The operation of the lower pair need not be described; they complete the process, and leave nothing unconverted into flour which could add either to the weight or the quality of the loaf. In considering this arrangement, we cannot fail to be struck with the analogy subsisting between it and that which we observe in the construction of the jaws of animals—a circumstance which assures us of its philosophical superiority.

"There were three trials as regarded the old system and the new. The first experiment on the old mill gave a discharge of 16 lbs. of flour in five minutes, which was equal to 192 lbs. per hour; while upon the patent mill there was a discharge of $38\frac{1}{2}$ lbs in five minutes, or 462 lbs. per hour. The difference, therefore, on that experiment was, against the old system, 270 lbs. per hour. The second experiment tried was even more favourable as regarded the new system.

"Two conical mills worked against two on the flat principle for an hour, ascertained exactly, and with the following results:—Conical mill (No. 1.) produced $8\frac{3}{4}$ bushels; ditto (No. 2) $7\frac{3}{4}$ bushels; Flat mill (No. 1.) 3 bushels; ditto (No. 2.) 3 bushels."

ORGAN MACHINERY.

At the late meeting of the British Association, Mr. Forster (of the firm of Messrs. Forster & Andrews, organ-builders, in Hull) gave a description of certain Improvements in Organ Machinery; more particularly connected with the pneumatic lever, whereby greater facility would be given to the organist. He also introduced several pieces of machinery, likely to cause a complete revolution in the structure of that part of the instrument; others relative to the prevention of noise and friction, which latter had hitherto been an obstacle in the elasticity of the touch. During the subsequent discussion, Mr. Forster said the late Mr. Booth, of Wakefield, invented and applied the pneumatic lever to organs for aiding in obtaining wind, in 1823; but the lever for the keys was not known till 1831, when Mr. W. Hamilton, of Edinburgh, and Mr. Barker, an Englishman, residing in Paris, simultaneously made the application. The Rev. W. V. Harcourt stated that the organ there was so heavy to play that the most admired anthems could only be got once or twice a year. The improvements, he believed, would obviate that difficulty. He had seen Dr. Camidge in a complete state of exhaustion from the manual

labour some of those performances required. The Chairman complimented Mr. Forster on the improvements exhibited.

WASHING CLOTHES WITH STEAM.

THE *New York Tribune* describes a Machine for Cleaning Dirty Linen by Steam, by which the clothes are washed and dried ready for the wearer, in less than thirty minutes. It consists of a strong wooden cylinder, four feet diameter, and four and a half feet long, mounted on a frame, so as to be driven by a band on one end of the shaft. This shaft is hollow, with pipes so connected with it that hot or cold water, or steam, can be introduced at the option of the person in charge. The cylinder being half full of water, a door at one end is opened, and from 300 to 500 pieces of clothing are thrown in, with a suitable quantity of soap, and an alkaline fluid, which assists in dissolving the dirt, and bleaching the fabric. When the cylinder is charged, it is put in motion by a small steam-engine, and made to revolve slowly, first one way a few revolutions, and then the other. During this operation the steam is let in through a double-mouthed pipe, somewhat in the form of the letter X, one mouth being in and the other out of the water; the steam, entering the water at the immersed end, is passed through the clothes for fifteen or twenty minutes, and then escapes at the other. The steam is now cut off, the warm water drawn off, and then cold water introduced, which rinses the articles in a few more turns of the cylinder. The drying-machine seems, from the description, to be very similar to, if it be not identical with, the hydro-extractor, or revolving machine, by which water is driven out of goods by centrifugal force, invented some few years back by Mr. Seyrig, and manufactured by Messrs. Manlove and Alliott, of Nottingham. A cylinder of wire network is made to revolve at a very rapid rate within a closed cylinder, by which all the moisture is carried to the outside case. It is said that with the washing machine, one man and three women can wash from 3000 to 5000 pieces a day.

BATE'S NEW FIRE-ESCAPE.

THIS invention differs from the existing Fire-Escapes in this important respect—that it is intended to form a permanent adjunct to every dwelling, so as to be at all times available and self-acting in the event of the outbreak of fire. The machine consists of a cylindrical tube or shaft, built of brick, stone, or zinc, attached to the house, and running up its whole height, either in front, at the back, or at the angles. This shaft is two feet six inches in diameter internally, and an entrance into it from each of the upper stories is afforded by a fireproof door, exit being obtained by a door at the bottom, which opens by a spring. The cylindrical shaft contains a canvas tube, running nearly the whole height of the house, and having four or five rows of vulcanized India-rubber springs. In the case of fire, the inmates of the dwelling will effect their escape by descending through this curious tube, which, being possessed of the property of expansion or contraction, adjusts itself readily to the

bulk of any individual, and at the same time keeps up a sufficient pressure upon the sides to prevent a too rapid descent. The entrance doors open into the thickness of the wall, and close by a spring as soon as any person has made his escape, in order to exclude smoke or sparks from the tube. There are also openings in the canvas corresponding with the entrance doors ; the exit door is opened by a spring, which is acted upon by the weight of the person escaping ; and having safely delivered one precious freight on to the pavement in front of the house, the door is made immediately to close again of itself, so as to be ready for the next comer. At the bottom of the tube an elastic buffer, or cushion, is provided, which has the effect of rendering the rapidity of the descent innocuous. The machine is calculated to be capable of delivering as many as twenty persons in the space of two or three minutes ; and it is so contrived that invalids may easily effect their escape, whilst young children can be safely borne upon the shoulders of adults. One instrument is capable of doing duty for two houses ; and the expense of fitting up each machine is estimated at from 30*l.* to 40*l.* There is, however, a cheaper application of the invention for the smaller description of dwellings, which would reduce the expense to 5*l.* per house.—*Times.*

IMPROVED WHEELBARROWS.

At the late meeting of the British Association, Captain Wilson called attention to a newly constructed Wheelbarrow, which will enable the labourer to perform double the amount of work ; as, by the alterations, the barrow is capable of holding twice as much, and requires no more exertion to wheel than that at present in use. The best constructed barrow for certain purposes, is the washer-woman's wheelbarrow, which has a stage raised over the wheel for the linen-basket. The present example is the more complete, carrying out fully that idea. The first difference of the new barrow from the one in use is, that the wheel is sunk into the floor of the barrow, thus throwing a great portion of the weight on the top of the wheel, instead of its being, as previously, between the hand and the wheel, and by this alteration can be doubled the quantity of the load. The floor of the barrow is broader at the handle than at the wheel, as by increasing the balance and pressure on the hand, to counterbalance the weight beyond the fulcrum, is extinguished the oscillation. The handles are a separate joint from the framework of the barrow, and are raised, so as to decrease the first lift as much as possible ; and by this arrangement they bring the weight below them, and cause a horizontal pressure, instead of at an angle of thirty to thirty-five ; they thus have a fair forward movement, instead of the wheel being pressed into the ground. A brass pin is placed in the tip of the hand-board, directly in a line with the wheel, so that it will serve as a guide to the labourer when he requires accuracy in his work.

MANUFACTURE OF BOOTS AND SHOES.

Mr. J. Sparkes Hall has read to the Society of Arts a paper

on the "History and Manufacture of Boots and Shoes," in which he gave an elaborate account of that article of costume, from the earliest period to the present time, illustrating his remarks by reference to a large collection of specimens and diagrams, many of the latter being taken from Egyptian and other remains at the British Museum. Mr. Hall gave a most interesting extract from an essay on boots, and shoes, and slippers, written by Professor Camper, of Leyden, about a hundred years ago, and then came to the practical part of the question—the boots and shoes of the present day, and how they were produced. Boots were preferable, he said, to shoes, as they gave greater support to the feet and ankles. The inconvenience of lace and button boots was then referred to; and the substitution of elastic web sides, introduced by Mr. Hall about twenty years ago, was thought to be preferable. Some difficulties were at first encountered in getting a web which should be at all times and seasons perfectly elastic and pliable, and should return to its normal state on the removal of strain. This had been attempted with spiral wire, and with the ordinary India-rubber, but it was found that the one was too rigid, and that the other, on a cold day, lost all its elastic properties. After a series of experiments, and the introduction of vulcanized India-rubber, the exact elasticity required was obtained.

THE TOBACCO-PIPE TRADE

Is suffering from the excessive competition with the French Fancy Clay Pipes. At one time the Dutch enjoyed a tolerable share of the pipe trade in this country, in consequence of their getting them neatly moulded. The British pipe-makers, though possessing the best fields of clay for this purpose, are far behind both the French and the Dutch in the method of moulding fancy clay pipes. The effect of the competition has been, it would seem, to increase the number of the London tobacco-pipe manufacturers from three or four to about three or four hundred. The quantity of long pipes supposed to be made in London daily, is a little above 1000 gross; and if it is estimated that there are 350 men engaged in the work, this will give on an average, as the production of each man, about three gross per day. The price varies from 1*s.* to 1*s.* 6*d.* per gross. Several attempts have been made within the last few years to produce the ordinary clay pipes by machinery; and it is rather surprising that what would seem to be so simple a thing should not hitherto have been attended with success.—*Journal of the Society of Arts,* No. 37.

SEWING MACHINES.

Mr. A. Newton, of Chancery-lane, has patented an improved Sewing Machine, consisting in an arrangement of machinery wherein a bearded needle is employed for throwing a line of looped stitches into the fabric that is required to be stitched. This fabric is hung upon pins projecting from two circular racks, which move in grooves formed in the face of a circular frame. These racks are driven by pinions taking into their teeth, and the fabric is thereby passed under

the action of the needle, which, having a quick reciprocating motion, similar to that of the needles of stocking-frames, and being in like manner supplied with thread, is passed backward and forward through the fabric, leaving a chain of loops on the inner face of it. A stiletto, carried by the same arm, pierces the holes for the needle to pass through.

Mr. W. E. Newton, also of Chancery-lane, has patented certain Machinery for Sewing by means of a double-looped stitch. There are two needles employed for this purpose, one of which works vertically and the other horizontally; each needle carries a separate thread, which are looped into each other alternately, the cloth or material to be sewn being fed forward under the vertical needle. The machinery comprehends also an arrangement for keeping the sewing-threads at a proper tension, as they come from the spools or bobbins on which they are wound.

THE LANCASHIRE SEWING-MACHINE.

A MACHINE bearing the above title, which has attracted a great deal of attention, and is coming into very general use in London and the large provincial towns, has been exhibited in operation at the offices of the Company formed for the purpose of carrying out the patent, No. 2, Lawrence-lane, Cheapside. From the description of this Machine, it will be perceived that all the stitches will be of uniform length, that the tension of the thread in each place will be constant, and that the stitching will be much stronger than that produced by hand-work. Every portion of a garment may be sewn by this machine with rapidity, strength, and extreme neatness, excepting only the stitching of the buttons and button-holes, and without regard to the work being light or heavy, coarse or fine. It admits also of a successful application to gaiters, boots, shoes, corsets, sacks, bags, sailcloths, &c.

The stitching in this machine is effected by two needles, each of which is supplied with thread from its own bobbin. One needle working vertically, and the other horizontally through the loops made by the first, a chain-stitch is produced which possesses great beauty as well as superior strength. The entire apparatus, which stands upon a square foot of surface, and is only about a foot in height, is actuated by a small, heavy wheel, to which a handle is attached; and in very rapid work this handle is drawn by a treadle and link. Upon the shaft, at the end of which the driving-wheel is keyed, is a cam-groove, in which the short arm of a lever terminating in a globe is made to work. The upper end of this lever receives a reciprocating motion from the continued action of the machine, and the length of stroke thus obtained is employed, together with a subsidiary arrangement, for giving motion to the vertical needle. A large arm rises from the apparatus, at the back, and stands forward, its front extremity terminating in the apparatus which carries the needle. Immediately underneath the top plate of the machine, and so placed as to act upon the same point as the extremity of the vertical needle, is the horizontal needle. This instrument is of a spiral form, the par-

ticular curve of which ensures the perfection of the work. It is mounted on a short vertical arbor, which carries a toothed pinion. A toothed arc gears into this, and the arc having a reciprocating motion imparted to it by a cam-groove apparatus upon the main-shaft, participates in that motion. The bobbin for the vertical needle is placed vertically in a convenient situation at the top of the machine; by means of a tightening-screw the tension of the sewing-thread is adjusted, and with it the tightness or looseness of the sewing. From the bobbin the thread is conducted through an eye fixed on the apparatus, and then through the eye of the needle, which is not far from the point, and finally returned upwards before the operation begins. The bobbin for the horizontal needle is mounted on an horizontal axle in a corner of the apparatus underneath the top plate. Its thread is laid in a small groove formed in the outside of the spiral, and is finally brought through an eye near the point.

If this general description of the machine is understood, there will be no difficulty in comprehending its operation. The cloth, having the line of sewing creased, or otherwise marked out, is laid upon the top plate, with the beginning of the line immediately under the vertical needle. If the machine be actuated slowly, it will be seen that the vertical needle is driven downwards through the cloth, and that immediately after it is drawn back the continuous action of the machine drives the horizontal needle through the loop which it leaves. Thus the thread of the vertical needle embraces that of the horizontal one, at the same time that the latter also enters the cloth. By the aid of another cam, a short stroke is given to a small platform having a surface cut into minute pyramids, so as to enable it to grasp the cloth firmly when pressure is made upon it from above, by means ot a plate with a spiral spring re-acting against a fixed obstacle. The result of this simple contrivance is, that at the completion of each stroke of the needles the motion of the platform carries the cloth from under the vertical needle, and that needle at each successive stroke, and the horizontal needle also, works in new cloth. As the length ot stroke of the platform admits of adjustment at the pleasure of the operator, it follows that the stitching can be made as coarse, or as fine, as is desirable. The machine being thus rendered self-feeding, it is only necessary to guide the cloth in such a manner that the needles shall work upon the required line. It is equally indifferent to the success of the operation, therefore, whether the sewing be required to take place in a straight line, or upon a curve, to turn a sharp curve, or to make a series of zigzags.

Speaking of this invention, upon its introduction from America into Glasgow by Mr. Darling, the *Glasgow Chronicle* says:—

"Sewing is effected by this machine with amazing rapidity, running off in something less than a minute a line of stout sewing which an ordinary seamstress would scarcely overtake in the course of half an hour! Line after line it traces with unabating celerity and ease, till the two bobbins which supply the thread to the double needle machinery be wound off. By the hand, the machine may be driven at the rate of 500 stitches per minute; by the foot, at nearly twice

that rate. Nor must it be supposed that the work executed at this extraordinarily rapid rate is loose, irregular, 'slop' sort of work. On the contrary, it is strong, close sewing, beautifully regular, and altogether such as it would require a very firm and well-practised hand to equal."—*Mechanics' Magazine*, No. 1562.

SALTAIRE.

THIS huge Worsted Manufactory was opened on September 20, 1853, with an entertainment on a scale of corresponding magnitude; 3750 persons, including 2500 operatives, having sat down to dinner together on the occasion, which combined not only the formal opening of the establishment, but the completion of the fiftieth birthday of the proprietor, Mr. Titus Salt, and the majority of his son. Saltaire is near Shipley, on the Aire. We quote some particulars from the *Bradford Observer* as to the extent, &c., of the works. The area appropriated to the buildings is computed at 6 acres; while the several floors in the mills, warehouses, and sheds, form a superficies of 55,600 yards, or 11½ acres. The mill, which runs from east to west, will be 550 feet in length, and 72 feet in height above the level of the rails It includes six stories, and is constructed of massive stonework in the boldest style of Italian architecture. The walls look like those of a fortified town. The floors are formed on arches of hollow brick, made on the ground by Clayton's patent process; the openings in the bricks being used for the purposes of ventilation. Rows of ornamental cast-iron columns and massive cast-iron beams support the arches. The roof is of iron. The windows, of large size, are entirely filled with immense squares of cast plate-glass. The whole of this building is fire-proof. The whole of the works are constructed of stone, supplied by twenty quarries in the surrounding neighbourhood. The gas-works are upon White's hydro-carbon system, and are calculated to supply 100,000 feet per day for 5000 lights, in mills, sheds, street, and houses of the work-people. 4500 hands will be required to keep these works going. This will involve an addition to the population of Saltaire of from 9000 to 10,000 persons. To accommodate these, Mr. Salt proposes to erect forthwith 700 dwelling-houses of various classes, replete with every convenience requisite for the health, comfort, and well-being of the inhabitants—a noble opportunity, which it is to be hoped will be fully taken advantage of. The architects are expressly enjoined to use every precaution to prevent the pollution of the air by smoke, or the water by want of sewerage or other impurity. Wide streets, spacious squares, with gardens attached, ground for recreation, a large dining-hall and kitchens, baths and washhouses, a covered market, schools, and a church, each combining every improvement that modern art and science have brought to light, are ordered to be proceeded with by the gentleman who has originated this undertaking.

JACQUARD LOOM.

TWO nieces of Jacquard, the well-known inventor of the Loom which bears his name, have been compelled, by poverty, to offer for sale the

Gold Medal bestowed by Louis XVIII. on their uncle. The sum asked was simply the intrinsic value of the gold, £20. The Chamber of Commerce of Lyons, becoming acquainted with the circumstance, agreed to become the purchasers of it for £24. "Such," says a French journal (*Cosmos*), "is the gratitude of the manufacturing interest of Lyons for a man to whom it owes so large a portion of its splendour."

FLAX IN IRELAND.

At the monthly meeting of the Committee of the Royal Society for the Improvement of the Growth of Flax, held in Belfast on 30th of March, a sample of perennial flax was shown, which had been found growing wild in the county Cork. A letter was written from Mr. John Egan, Limerick, enclosing a sketch of a new Scutching Machine invented by him, which he stated to be capable of cleaning 10 cwt. of fibre daily, with the labour of four persons. Mr. De Kock, the Society's Belgian instructor, had returned from a trip to Flanders, where he had contracted for three oil mills on the Flemish model, which would be erected by private individuals in Ireland. Attention was drawn to a new Machine for Cleaning and Scutching Tow, the invention of Messrs. Calvert and Garnett, of Cleckheaton, Yorkshire, a letter from whom was laid before the meeting, inclosing a specimen of the metal teeth used for the purpose. The machine consists of metal cylinders armed with these teeth, and it was stated to do its work much more perfectly than the implement termed a "devil," which is commonly employed for the purpose. It was further stated to be capable of cleaning thoroughly not only the ordinary scutch mill tow, but also that of the coarsest and dirtiest kind produced by the buffing socks, and to convert it into fibre worth £10 to £12 per ton. A great quantity of this sort of scutch mill refuse has been hitherto burnt, as it was found that no means previously adopted had been successful in cleaning out the fibres. Hence, if generally adopted in scutching districts, the new machine might prove of great advantage in enabling the waste to be turned to more profitable account.

NEW KIND OF COTTON.

The editor of the *Tribune* has seen a specimen of a new and very beautiful sort of Cotton, brought from among the Pine Indians of New Mexico by an officer of the Mexican Boundary Commission. Its peculiarity consists of a fine, silky staple, superior in length and strength to all kinds previously known. The seed has been introduced into Texas, and the plant will soon be grown there extensively. It has also the great advantage of not degenerating, and not requiring a renewal of the seed. The plant, if all these peculiarities are proved permanently to belong to it, must effect a revolution in cotton raising. —*American Paper.*

COTTON ROPES FOR SHIPS, AND COTTON NETS.

There is a novelty about the *Sovereign of the Seas* that doubtless will be soon imitated by other vessels. The ropes which form the running rigging are of cotton, which we understand is not only capable

of a lighter twist, but is not liable to become deteriorated by friction in the same degree as hempen cords. After they have been in use too for years, they can be sold for nearly as much as the original cost. These ropes are quite smooth, and run with great rapidity through the blocks. The sails also of this vessel are of cotton, two sets of cotton sails costing only the sum paid for one set of linen. Fishing nets made of cotton are much used in America.

CHINA GRASS.

The Rheea Plant, or the true Chinese Grass, is already cultivated by natives of Assam to make fishing lines and nets. Its shoots can be cut down several times a year, and its fibres they know how to separate. Major Hannay has been able to improve the process by the assistance of the Chinese in Assam. Captain Thomson, of the house of Thomson & Co., ropemakers, of Calcutta, found the Rheea-fibre from Rungpoore to be three times stronger than the best Russian hemp, and the wild Rheea everything that could be desired for rope-making, though the cultivated kind, probably from a difference in the preparation, he thought a little too rigid for the running rigging of ships. But as there is no doubt of the strength and flexibility of their fibres, it is to be hoped that they will, when more generally known, be more extensively employed for rope-making both in India and England, especially as they can be produced at a price under that of Russian hemp. Neither the Royal nor mercantile navy need therefore be restricted to European sources of supply for this essential part of their equipment; but as the Rheea of Assam, like the Chu-Ma of China, produces fibres of different degrees of fineness, according as they are taken from the later or the earlier crops, so may they, though rivalling those of grass cloth in fineness, exceed those of Russian or of Polish hemp in strength.—*Dr. J. Forbes Royle, in the Journal of the Society of Arts.*

SINGULAR DISCOVERY IN THE PRODUCTION OF SILK.

It has long been known to physiologists that certain colouring matters, if administered to animals along with their food, possessed the property of entering into their system and tinging the bones. In this way the bones of swine have been tinged purple by madder, and instances are on record of other animals being similarly affected. No attempt, however, was made to turn this discovery to account until lately, when Mons. Roulin speculated on what might be the consequences of administering coloured articles of food to silkworms just before spinning their cocoons. His first experiments were conducted with indigo, which he mixed in certain proportions with the mulberry-leaves serving the worms for food. The result of this treatment was successful—he obtained blue cocoons. Prosecuting still further his experiments, he sought a red colouring matter, capable of being eaten by the silkworms without injury. He had some difficulty to find such a colouring matter at first, but eventually alighted on the *Bignonia chica;* small portions of this plant having been added to the mulberry-leaves, the silkworms consumed the mixture, and produced red-coloured silk.

NEW MATERIALS FROM WESTERN AFRICA.

Mr. Thomas Clegg, of Manchester, proposes two New Materials for Textile Manufacture, which have been recently received from the south-west coast of Africa. The first of these is a fibrous substance sent by a missionary at Abbeokuta, as "Red Cotton." It is not produced in the neighbourhood of that place, but is brought thither from the Houssa country to the northward, in considerable quantities; and the people who bring it state that the deep red colour which it bears is natural; but the writer of the letter adds, that the Chief at Abbeokuta "thinks they lie." The scepticism of the Chief is undoubtedly well founded. The material, which is not cotton at all, but an entirely new species of silk, is unquestionably dyed, probably with alkanet-root, which, we believe, is abundant in Africa. If sent in its natural state it will undoubtedly prove a very useful material for the waste silk spinners. The letter does not contain any information as to the price which this material bears in Africa; but as it is stated to be produced in great abundance, it seems probable that the price will be moderate. The other material to which we have referred, is a new and somewhat peculiar description of wool, stated to be brought from Quitta, a town on the coast to the westward of Abbeokuta; but as the climate of the coast must be very unfavourable for the production of wool, we think it is probably brought from some of the mountainous regions in the interior of the continent. Like the dyed silk, it was sent to this country as a sample of cotton, and with it was some yarn, purporting to be spun from it. That, however, is unquestionably an error, as the yarn is made from cotton. The wool seems of tolerably fine quantity, of a pale buff colour, apparently natural, and is worth, we are told, about 1*s.* 3*d.* per pound. If it can be found in quantity, it will prove a very acceptable boon to the woollen manufacturers of this country, whose supplies of raw material have latterly proved very insufficient.—*Manchester Guardian.*

DAVIES'S PATENT PEDOMOTIVE CARRIAGE.

This Carriage consists of a single wheel of 6 feet 6 inches diameter, with a seat and winch attached to the centre on either side. The wheel of 7 feet diameter covers 21 feet at each revolution, and the weight of the whole averages from 80 to 90 lbs. A great merit in the invention is the small amount of friction and the mode of suspending the weights. The weight is thrown a little in front of the axle. From various trials it has been shown that two persons can travel with ease at the rate of sixteen miles an hour; and that so little are the legs called into play (the body being quite at ease, and supported by a padded cushion in front), that the fatigue of working the carriage sixteen miles is not so great as that of walking four miles. In wheeling round, the person on the inner side throws his whole weight on—which raises the outer rider off his legs, and the wheel comes round instantaneously. The inventor and others feel assured that thirty miles an hour might be accomplished without

any great effort. The invention is altogether a great improvement on the original velocipede.

NIXEY'S PATENT REVOLVING TILL.

MR. NIXEY, of Moor-street, Soho, has patented this invention to provide the means of protecting both the trader and his customers, in a rapid succession of payments over a counter, from the imputation of fraud or of error where no ground exists for it; and to fix the fraud or the error on the right party, when the transaction has not been fairly or correctly adjusted. For this purpose he has invented the "Revolving Till" described in his patent. It consists of a cylindrical box, about four inches deep, and six inches in diameter, which is either screwed down upon the counter, over the money-drawer, or else is let down flush with the counter itself. In either case, the operation of the instrument is the same, and extremely simple and effective. A short upright axis supports a shallow circular tray in the top of this box, which is divided into six equal sectors by partitions. Each sector has a movable bottom hinged upon the lower edge of the partition, and opening in the same way. In general, these bottoms will be supported; but at one part of the revolution of the tray the bottom will give way, and that sector will discharge its contents through a hole in the counter, within this instrument, into the drawer below. Money paid by a customer, is put into one of these sectorial compartments. A strong plate of plate-glass prevents both tradesman and customer from touching cash whilst in the tray; but the plate has a sector cut out of it corresponding in size and position with that of one of the sectors of the tray, to enable the money to be deposited in it. The money being placed in the open sector, the tradesman touches a small ivory handle connected with a simple escapement arrangement; and the tray is carried by a sudden movement through the sixth part of a revolution, thus bringing the money just paid in under the plate of glass, and, in fact, impounding it. Another open sector is now ready for the next payment; and the same operation being repeated with the handle, it is evident that five successive payments may thus remain in sight together, and sufficiently long to admit of the adjustment of any matter of dispute. At the next touch of the handle, the first sector spoken of is brought into the position where its bottom is no longer supported, and the money falls into the drawer below.

NEW TELEPHONE.

A VERY curious System of Telephony for the transmission of language at great distances, by means of musical sounds, has been invented by M. Sudre, at Paris. The plan consists in making use of three notes placed at given intervals; and which, combined or repeated according to certain rules, are capable of rendering the most complicated sentences. Thus, one of the company writes a few lines, and on M. Sudre reading them, he strikes his three notes alternately, according to his method, when a third person, without

any previous knowledge of the writing, repeats the words merely from hearing the notes. The system has been, it is understood, tried on a very extensive scale, to test its applicability to naval and military purposes, and is stated fully to justify the high encomiums the French Institute and other scientific bodies have bestowed on it.

HARRISON'S PATENT WATER AND SPIRIT METER.

In this instrument, the liquid, in passing through the meter, acts in two opposite directions against two flexible diaphragms placed between chambers, into which it is alternately admitted; thus displacing at every movement, from the one chamber, a quantity of liquid equal to that admitted into the other. This action gives motion to spindles, which is ultimately communicated to the registering hands; and thus the dial of the meter shows accurately, at a glance, the quantity drawn off in gallons, quarts, pints, &c. The instrument is said to be simple in construction, certain in action under any pressure, and requiring no regulator to govern its movements; and the apparatus may be connected at once to the main to the cask, and the quantity sold or drawn off at any part of the premises duly registered.—*Journal Soc. Arts,* No. 48.

HOW TO GET HONEY FROM BEES WITHOUT SMOKING.

Mr. M'Leod, head gardener at Altyre, has introduced a system in the Management of Bees, which bids fair to supersede entirely the long-practised plan of smoking hives at the end of harvest, and destroying the bees. Mr. M. has succeeded in obtaining a larger quantity of honey from a given number of hives, and of better quality than ordinary, without the loss of any of the bees. The multiplying process, too, goes on as uninterruptedly as under the old mode. Various shapes and kinds of hive are used. One, which may be regarded as a model, is of wood, painted green, and of a cottage shape. It has glass panes in different parts, through which, on removing a shutter, the bees may be seen working. At the upper part behind, a hinge opens, and shows six bell-glasses, which hold about three pounds of honey each. The bees have access to these glasses through a small aperture in the board over which they are set: as the honey is deposited here first, the bees work downwards; and when the glasses are full they can be removed, and emptied at pleasure. When they are replaced, a fresh supply of honey is again deposited. Although this process goes on so as to leave the hive very little for winter provision, Mr. M. says he never had occasion to feed the bees, and that the larger the hive and the greater the number of bees, the less sustenance through the winter do they require. The same process, slightly varied, goes on with the other ordinary skeps. There is a small hole made in the top of the straw hive, on which is set a lath box, eight and a half inches square and six inches deep, with a bit of window-glass in front. When this box, which will contain about 14 lbs. of honey, is full, it is removed and emptied, and filled a second time; 28 lbs., and sometimes 32 lbs., of the finest virgin honey, may be thus abstracted from a hive in a

season, still leaving as much in the body of the skep as will be sufficient maintenance to the bees through the winter. Smaller hives have smaller boxes; the quantity of honey taken of course being proportioned to the strength of the hive.—*Forres Gazette.*

VAST ICE-HOUSE.

For Boston, United States, has been built an Ice-House fifty feet long by twenty-nine feet wide; twenty feet high, independent of the main roof, which has a shed built over it to protect it from the sun; and the eaves of the roof project ten feet on all sides beyond the main building. On the ground floor is to be a retail room, eight feet by twenty. The ice-room, capable of holding four hundred tons, is protected all around from the atmosphere by two apartments, each three feet wide, the outer one filled with saw-dust, and the inner one with charcoal. Under the floor, the same materials are used. The rooms are supplied with gutters which carry off the water of such quantity of ice as may melt.

POCOCK'S PATENT PORTABLE KITE AND HAWK.

A specimen of this apparatus has been submitted to inspection. The Kite is made of green calico, stretched upon a wooden framework, so constructed as to be easily disjointed when there is no further use for its assistance, then to be packed into a shape something resembling an ubmrella. The Kite has attached to it an artificial Hawk, which, on the Kite becoming elevated, hovers in the air over the spots in which grouse or partridges are supposed to lie. The effect of this manœuvre is to cause the birds, though they may be very wild, to keep down until the sportsman advances sufficiently close to obtain a good shot, when they take wing. The Kite and Hawk require a person to be specially devoted to their superintendence. —*The Field.*

A FLYING CHARIOT.

A model of a vehicle constructed for the purpose of aërial navigation was deposited in the late Exhibition at Dublin. It is the invention of Lord Carlingford; and in a communication to a friend, it is attempted to be proved that it fully bears out its right to the above appellation. It is said to have two expanding stationary wings to bear its weight, and two screw wings in front to draw it forward.

CAMBAY STONES.

Cambay was celebrated for its Cut Stones above 2000 years ago. They are mentioned by the author of the "Periplus" as onyxes, porcelain stones, or probably jaspers, dyed stones, &c. Uertomenes, in his account of Cambay, in 1503, mentions "A mountain where the onyx stone, commonly called the cornelian, is found, and not far from this, another where chalcedony and diamond abound." Captain Hamilton, who visited Cambay in 1681, says: "The cornelian and agate stones are found in this river, and nowhere else in the world.

Of cornelian they make stones for signets, and of agates cabinets entire, except the lids; some, fourteen or fifteen inches long, and eight or nine inches deep, are valued at £40. They also make bowls of some kinds of agates, and spoons, and handles of swords, daggers, and knives, and buttons, and stone seats, and snuff-boxes of great value." In Milburn's "Oriental Commerce" they are mentioned as forming extensive articles of purchase at the East India Company's sales, though for many years past scarcely any of them appear to have been sent to Europe; China taking off the chief supplies. Two years ago considerable exports were made from Bombay of blood-stone, in its rough state. Such large profits were obtained from the earlier cargoes that the market was glutted almost immediately; and fine specimens, which used to sell at 3*s.* or 4*s.* a pound, are now to be had in the Bombay market in abundance, at from 2*s.* to 3*s.* per cwt.; and 28 lbs. weight of them, some eight or ten inches long, and five or six inches thick, have been purchased for a couple of rupees. Were the native stone-cutters a little better instructed in the art, and taught to make up articles to meet English taste, there seems no reason to doubt but that the manufacture might very quickly be made a most extensive and lucrative one. The stones themselves abound in the country, and are to be had at the most insignificant prices; so are the corundum and the lac employed in cutting them; and the expensive article of diamond-dust, universally employed by lapidaries in this country, where it is of the utmost importance to avoid the expense of labour, is never thought of where this class of workmen are content with 10*s.* a month, for which they will turn out as much work as an Englishman at £4. Lapidaries in England complain of the Cambay stones as being badly finished, and in this state unsaleable. This arises from the want of instruction of the native lapidaries, who, if taught, are quite capable of putting any amount of finish on them that may be desired.—*Journal of the Society of Arts*, No. 50.

AMERICAN LEATHER TRADE.

THE Leather Business of the United States is very extensive: not less than a million and a half of hides are imported into the country every year, made into leather, and used for different purposes. The capital invested in the tanning business has been represented in some statistical tables as amounting to 19,000,000 dollars; there are about 6500 tanneries in the different States, in which no less than 12,000,000 sides of leather are tanned every year, the value of which amounts to 33,000,000 dollars. The best articles ever published in the United States, on Tanning, appeared in the *Scientific American*, vol. 5. They were written by one of the most experienced tanners in the country. Since that time a very excellent work on the subject, by Campbell Morfitt, has been published by H. C. Baird, of Philadelphia. He describes no less than twenty-six different tanning processes, some of which are very curious, some ridiculous; some good, others bad. The work contains Hibbard's patent process, but not that of Eaton, which has been patented since, and by

which very excellent leather has been made, we have been told, in ten days. The old methods of tanning were exceedingly tedious, and the grand object with tanners, has been to shorten the process and obtain as good leather as by the old plans.—*Scientific American*, No. 39.

LEATHER WITHOUT BARK.

It was stated in the *Mechanics' Magazine*, of September 18th, 1852, that a Mr. Preller had taken out a Patent for Preparing Skins with materials of which Bark formed no part. He used, on the one hand, vegetable substances consisting largely of starch, and containing little gluten, such as barley flour, rice flour, or even starch itself; on the other, butter, milk, grease, and other fatty animal matters; to which he added salt or saltpetre in certain proportions. With this mixture, skins prepared in the usual manner are smeared, after which they are agitated in a revolving cylinder for a certain length of time, when they quickly become ready for the currier.

In a late number of the same publication it is stated, that "this method of treatment is so remarkable for its originality, and attended with such excellent advantages in the course of manufacture, and in the character of the produced article with reference to the requirements of practice, as to promise nothing short of a complete revolution in the arts of the tanner, and the establishment, to a certain extent, of a new criterion by which the qualities and value of leather for practical purposes are henceforth to be estimated. A large factory in Lant-street, Southwark, has been fitted up by Mr. Preller; and he is there carrying on his manufacture to a very considerable extent, and with a degree of success which could hardly have been supposed would attend his efforts in the comparatively short time which has elapsed since he began. His leathers have already acquired a high reputation in the market, and are rapidly getting into favour for a variety of manufacturing purposes, especially for driving bands, for which their superior strength, flexibility, uniformity of texture, and durability, render them eminently serviceable."

The difference in quality of the skins thus treated, and such as have been tanned with oak-bark, catechu, or similar substances, is represented to be strikingly in favour of the patent process.

The peculiar merits of Preller's method are said to be these. It reduces the weight of leather, and at the same time increases its strength; and this takes place to such a degree that "it has been found that oak-tanned leather of 3-8ths of an inch in thickness is incapable of resisting a strain which Preller's leather, 1-4th of an inch in thickness, will resist in constant working. A strip of it, a yard long, about half an inch in width, and 1-8th thick, gave way with a breaking weight of 6 cwt. 20 lbs.; while ox-hide, well tanned on the oak-bark system, and of the same dimensions, could only resist a strain of 5 cwt. As another illustration of the superior strength of Mr. Preller's leather for driving-bands, we may mention a circumstance which was told us at the factory, that on one occasion, to

lengthen a driving-band made of his own leather, he added to it a piece of oak-tanned, and that the latter gave way in the performance of its work. Sheep-skins, kid-skins, and some other species of leather, which in general may be torn asunder in the hands with the exercise of only a small degree of force, acquire in this process a strength which is quite surprising; of which we had experience ourselves, when a piece of split sheep-skin, of large size, was put into our hands, and we were requested to try to break it."

Another great advantage in Preller's process is represented by the same authority to consist in saving time in the process of preparing. "The thickest ox-hide requires only two days and a half to be fully converted by the application of this process, of which Mr. Preller showed us an example in the hide of a large prize ox, exhibited at the late cattle show. Under the most favourable circumstances, it now requires four or five weeks' subjection to the tanning liquor. Under the old process of tanning, in which the hides were placed in a pit, with layers of tan to separate them, and afterwards filled with water, a very considerable period has been known to elapse during the process; sometimes amounting to four years. This old-fashioned method has not been yet completely abandoned for more scientific modes, and contrasted with it, the great change which this invention has effected is the more remarkable. A walrus skin exhibited in the Great Exhibition took no less than four years to tan; but Mr. Preller estimated that by his mode of treatment the conversion would be perfect in sixty hours, allowing six periods of agitation in the drum, each of ten hours' duration. The economy of time in the conversion of the hide is a circumstance strongly favourable to the practical working of the system, and is calculated to give to this branch of industry a degree of activity not hitherto experienced.

It is further stated, that leather prepared thus, without tan, possesses greatly increased capacity for resisting the passage of water, combined with remarkable suppleness; so that for boots and shoes it is far preferable to tanned leather. "When ordinary leather," says our well-informed contemporary, from whom we borrow these particulars, "is boiled in water, it gradually hardens and becomes rigid; and if the operation be continued for half an hour, it will be found to have assumed a kind of woody texture, and to have become brittle. Some descriptions of leather, on the other hand, become converted into a mass somewhat resembling glue. When Preller's leather is tried in the same way, it gradually approaches to the condition of horn; but it requires several hours before that state is attained. In its ordinary condition, as before observed, it is remarkably supple, and that quality admirably fits it for being used in the soles of shoes; for the West and East Indies, in particular, this quality is highly advantageous, and, for the supply of troops, would probably be found to be attended with economy and productive of comfort."

We can hardly over-estimate the importance of these facts to country gentlemen; for, if further experience shows them to be fairly stated, of which we have no reason to doubt, then it is clear

that the timber on an estate will become seriously depreciated, and all valuations will have to be made upon an entirely new basis.

SUBSTITUTE FOR GUTTA PERCHA.

MR. RIDDELL, officiating superintendent surgeon of the Nizam's army, in making experiments on the Muddar plant of India (*Asclepia gigantea*), had occasion to collect the milky juice, and found that as it gradually dried it became tough and hard, like Gutta Percha. He was induced to treat the juice in the same manner as that of the gutta percha tree, and the result has been the obtaining a substance precisely analogous to gutta percha. Sulphuric acid chars it; nitric acid converts it into a yellow resinous substance. Muriatic acid has but little effect upon it; acetic acid has no effect; nor has alcohol. Spirit of turpentine dissolves it into a viscid glue, which when taken between the finger and thumb pressed together, and then separated, shows numberless minute and separated threads. The foregoing chemical tests correspond exactly with the established results of gutta percha. It becomes plastic in hot water, and has been moulded into cups and vessels. It will unite with the true gutta percha. The muddar also produces an excellent fibre, useful in the place of hemp and flax. An acre of cultivation of it would produce a large quantity of both fibre and juice. The poorest land suffices for its growth, and no doubt if well cultivated there would be a large yield of juice, and a finer fibre. A nearly similar substance is procurable from the juice of the *Euphorbia Tirucalli*, only when it hardens after boiling it becomes brittle. The subject is most important; and if common hedge plants can yield a product so valuable, the demand for which is so certain quickly to outrun supply, a material addition will have been made to the productive resources of the country.—*Journal of the Society of Arts*, No. 55.

In reply to this communication, Mr. George Buist states, in the above journal, that "having published a notice on the subject in the *Bombay Times* eight or nine months since, on receiving specimens of the gum from Dr. Riddell, Sir Richmond Shakespeare, resident at Gwalior, set on foot some experiments of a more minute description than those of Dr. Riddell, with the view of ascertaining its elecrical properties, when it turned out not to be a non-conductor; it conducted electricity as freely as a piece of untanned hide, and is therefore altogether unfitted for a coating to telegraph wires. We are not the less indebted to Dr. Riddell for his inquiries, and the muddar sap may serve some of the other uses of gutta percha where its electric properties are of no consequence. Many of its qualities are perfectly well known to the natives. In 1847 Major Ludlow sent me down some men from Rajputtana, to study European arts and manufactures at the School of Industry, then coming into existence under my charge, and amongst other things the use of the English turning lathe. The rats having eaten all our cat-guts, we were driven to the use of whip-cord for our lathes; and this again was continually annoying us by stretching and not recovering itself. One of my pupils remedied the difficulty by soaking the whip-cord in the milk of the muddar,

thus converting it into an elastic string which no animal would meddle with ; and he told me that in his own country it was employed for making leather and cloth waterproof, or bow-strings elastic."—*Journal of the Society of Arts*, No. 56.

GUTTA PERCHA PAPER.

PERON has invented a kind of paper made from gutta percha, which is considered to be superior to all other kinds for lithographs and engravings.—*Compt. Rendus de l'Académie des Sciences.*

ETCHING LIQUID FOR LITHOGRAPHERS.

CHEVALLIER & LANGLUME propose for this purpose, 6 parts of fused *chloride of calcium*, dissolved in 19 parts of rain-water, and filtered. In this solution 4 parts of gum-arabic are to be dissolved, and 1 part of pure muriatic acid added to it. This solution serves at the same time to etch and to gum, and, by its penetrating the stone, to keep it moist during the printing, a matter of great consequence.—*Gem. Wochenblatt des Gewerbevereins zu Köln.*

GUTTA PERCHA FOR STEREOTYPING.

IF a page of type set up for printing, be heated, and then pressed upon a flat block of Gutta Percha, a perfect matrix is produced, from which a Stereotype plate may be obtained by the ordinary galvanic process, which will give impressions fully equal to the original type.—*Polytechnisches Centralblatt.*

LIQUID INDIA-RUBBER.

A CORRESPONDENT of a New York paper, writing from Para, in Brazil, says :—"There is a method in preparing the gum, which has recently been patented, and which differs essentially from the usual curdling. The milk, as drawn from the tree, is put into large glass bottles and demijohns ; a preparation of some chemical nature, which is a secret, is mixed with the milk, and the bottles are securely sealed. In this way the gum is sent to the United States. It curdles twenty-four hours after exposure to the air, and forms a pure, white, solid, and remarkably strong rubber. There is only one house in Para which has the secret of this receipt, as I learn, and a member of the firm gives his personal attention to the preparation of the article, some thousands of miles in the interior of the country. The proprietors of the patent—as they say in Para—have a contract from an American manufacturer to take all they can furnish at 1 dol. 50 c. per pound, and he uses it all up in making suspenders, garters, &c. The ordinary rubber is gathered by Indians in the dry season, and is exchanged by them for the common whisky of the country — quite a pleasant beverage—cloths, and implements for extracting the milk. The merchants at Para buy it from second and third hands in preference to extracting it themselves, as they find that the Indians work better when hunting on their own account than when operating for employment."

SUBSTITUTE FOR BOTTLE CORKS.

M. Blain has invented a stopper for wine and other Bottles, applicable also for jars, for anatomical preparations, preserved meats, and all other things requiring to be made air-tight. This stopper is made of glass, and is in shape like a mushroom, the stem being slightly smaller than the neck of the bottle or vessel. M. Blain takes a tube of vulcanized India-rubber about an inch long, and of such a size as when dilated it will fit closely to the exterior of the neck of the bottle, and inserts into one end of it the top of the stopper. It is then, by means of a thread passing around the head, in a groove for that purpose, fixed securely in its place, the India-rubber tube standing like a chimney to the stopper. The bottle or vessel is then filled with the liquid, &c., to be preserved, and the stopper inserted. The India-rubber is then turned downwards, inside out, so as to cover the neck of the bottle, to which it is made fast, by a string passing round it, under a projecting rim; the string being then brought to the top of the stopper, where it is sealed. It is said to be in extensive use, and to answer admirably.—*Jour. Soc. Arts*, No. 37.

FOREIGN WINES, AND THE GRAPE FUNGUS.

Mr. W. Brockedon has read to the Royal Institution a paper on the "Treatment of Foreign Wines, and the extensive injury recently caused by a Fungus on the Grape." The first part of the lecture consisted of a description of the mode of making Champagne, to which Mr. Brockedon's attention had been particularly directed during a sojourn in the champagne-making districts of France. It is commonly supposed in this country that that kind of wine is manufactured from unripe fruit; but this is a mistaken notion. The fruit used for the purpose is a small red grape, well ripened; and the only difference in the fermentation of champagne from that of other wines is, that the process is conducted in small casks instead of in large vats, particular care being taken that it should be clear. The effervescing property of champagne is produced by a second fermentation when bottled; for which purpose a liqueur composed of a thick syrup of sugar-candy mixed with wine is poured into each bottle, which is then closed up, and after being allowed to rest for some time in an inclined position, to facilitate the fermentation, the bottles are reared on their necks. By this means the sediment, if any, collects near the mouth of the bottle, and on removing the temporary plug it is forced out. Considerable dexterity is required in conducting the operation; and the operator, the instant that the plug is taken out, thrusts in his forefinger to prevent the escape of the wine. The bottle is then placed upright, and is corked by a powerful machine. The waste of champagne from the bursting of the bottles is considered a criterion of its excellence; and this waste sometimes amounts to one-fifth of the whole vintage. The principal point mentioned by Mr. Brockedon, in reference to the manufacture of other wines, was the care taken in the selection of the grapes. None of the best wines are made from grapes of the same kind, the quality of the wine materially depending on a proper mixture of grapes from different vineyards.

Mr. Brockedon considers the Fungus which has of late years attacked the grapes as great a calamity to the wine-producing countries as the potato blight was to Ireland; and it is a remarkable coincidence that the fungus and the blight made their appearance in the same year. The fungus was first observed on some vines in England in 1845, and in 1847 it spread rapidly through the vineyards in the south of France, in some cases destroying three-fifths of the produce. It appears in the form of a white powder on the grape itself, when it begins to grow. Its immediate effect is to dry up the skin, which is split open by the expanding pulp, and the fruit is thus destroyed. The only remedy that has yet been discovered for the disease is the application of powdered sulphur to the flowers and early fruit; but in the open air it is found next to impossible to apply the sulphur effectually.

ARTIST'S GONIOMETER.

Mr. Twining has described to the Institute of British Architects, and the Society of Arts, this new Drawing Instrument invented by him, for measuring the angle of horizontal lines in a landscape or building. The Goniometer consists of a vertical rod, supporting a horizontal graduated semi-circular plate, above which a needle is moved in any direction, so as to be placed parallel with any line to be delineated. The angle indicated by the needle is then transferred to the drawing by means of another graduated semi-circular plate, fixed over the upper edge of the drawing-board; the apparatus being placed at a distance from the drawing corresponding with the width of the latter. Above the plate or dial is placed another in a vertical position, which can be moved vertically round its axis, and serves to mark the elevation or depression of any point above or below the horizon. Mr. Twining gave numerous illustrations of the breach of the laws of perspective by the great masters of art, and showed the importance of the measurement of angles, which his instrument was intended to facilitate. A fuller description of the Goniometer will be found in the *Mechanics' Magazine*, No. 1554.

DRAWING INSTRUMENTS.

At a time when the camera is attracting so much attention, and photographic images are by its means being produced in almost endless variety, we are too apt to overlook any other mechanical or optical arrangements calculated to facilitate the production of correct representations of objects in nature or art. We would direct attention to the Graphic Telescope, an instrument invented by Mr. Varley, which, although not new, is far too little known, as it affords almost unlimited aid to artists, architects, and draughtsmen. It presents to the eye correct images of any object which it may be desirable to trace, from any direction, and of any size we need. At whatever distance from the eye it may be eligible to place the paper, the images can be placed so that the image and pencil are made to coincide so truly that both are distinctly seen together; and from this exact coincidence both eyes remain open to see the pencil, though

a portion of one only sees the image. By its means also images may be reversed when necessary for lithographic purposes. In the graphic telescope the field of view is large, being about as wide as the paper is distant from the eye; and the picture or image may be extended every way by moving the telescope and shifting the paper, there being means of correction when needed. In its use, with a variety of power, we have unlimited choice as to the size of the images we intend to trace, and they may be drawn to the true perspective distance of the picture in which they are to be used. The telescope is peculiar, and differs from all others; it being constructed expressly for this purpose, to be capable of having the lowest powers as well as the highest, and with a large field of view. It may be described as a telescope between two reflecting speculums, by which an erect image is obtained clear of the telescope. The drawing surface may be placed in the most convenient position, either level or sloping, and the instrument can take images from every possible direction. Thus pictures or ornaments on a ceiling may be as easily traced as those in any other position. Mr. Horner, by means of the graphic telescope, produced one of the largest panoramas ever painted,—London as seen from the top of St. Paul's,—a task almost hopeless without such aid. To be able to trace a telescopic image, absolute steadiness, as well as lightness, is required, so as to afford facilities of transit from place to place; these the arrangements of the graphic telescope have effected; it is the lightest and steadiest instrument that has been provided for such purposes. The whole framing forms a series of triangles so opposed to each other as to produce the required stiffness by construction, and not by weight. The telescope, when prepared for use, is placed on a pyramidal stand, forming a stiff base, and holding it steadily over a table. Not only may portraits, animals, sculpture, shipping, and buildings, be correctly traced, but they may be drawn to an exact scale without measurement. Thus a most useful instrument is provided for artists, by which valuable time may be saved, and correct sketches made of all difficult subjects. It will also frequently find views of places too distant to be regarded by the unassisted eye.—*Journal Soc. Arts*, No 44.

IMPROVED PENHOLDER.

Mr. James Goodfellow has invented a new Penholder, in which the pen is held by a small cylinder, which moves easily in a tube, the cylinder being kept in its position by a light coiled spring within the tube. This spring gives the pen a great deal of flexibility, and prevents the point from entering the paper when writing with rapidity.—*Journal of the Royal Cornwall Polytechnic Society.*

CRAYON FOR WRITING ON GLASS.

M. Brunquell prepares a Crayon for Writing on Glass so as to enable the contents of glass vessels to be inscribed on them at once. He takes four parts of spermaceti (stearine), three parts of tallow, and two parts of wax, and melts them in a cup; six parts of minium and one part of potash are then stirred into it, and the whole is kept

warm for half an hour, and then poured into glass tubes of the thickness of a lead pencil. After quickly cooling, the mass may be screwed up and down in the tube, and cut to a fine point with a knife. This crayon will readily write on clean, dry glass.—*Dingler's Polytechnic Journal.*

ARTIFICIAL MALACHITE.

When a solution of sulphate of copper is precipitated in the cold by carbonate of soda or potash, the precipitate is at first voluminous, and of a blue colour; but left for awhile, and then washed, it becomes more dense and of a green colour, and has the composition of green Malachite as found in nature. A sort of malachite, it is also said, may be obtained by the reaction of coarse porous limestone on a solution of nitrate of silver, marking 12 or 15 degrees; and, when the action ceases, by plunging the mass into a solution of an alkaline bicarbonate, marking 5 or 6 degrees. The piece of limestone in the first case becomes covered with sub-acetate of copper, and this sub-acetate, in the next step, changes to malachite; or, if prolonged, to a double carbonate of copper and soda. The malachite is in small silky globules.—*Builder,* No. 526.

EDUCATION OF THE BLIND.

In a very interesting lecture delivered at the Royal Institution, the Rev. W. Taylor, M.A., has shown the extraordinary progress which has been made in providing, not only Instruction, but Recreations and Amusements for the Blind.

It is curious that our ingenious neighbours, the French, were the first to establish schools for these purposes in 1784; but the Germans have recently made the greatest advances; while the English, we are sorry to say, enjoy the distinction of being the most behind. Mr. Taylor proved that, with the aid of ingenious contrivances, the acquisition of almost all kinds of knowledge, the profundities of science, the delights of literature, the study and practice of music, and even the intricacies of the game of chess, are all within reach of the blind. The audience were much moved with the spectacle of a girl of 14 and a youth of 19 reading by the touch, with great distinctness, passages from books laid before them by the Reverend lecturer.

PAPER HOUSES.

Messrs. Bielefield have erected at their works near the Staines station of the South Western Railway, several very neat cottages, commodious stores, and handsome villas, the whole of which, with the exception of the frame-work, the doors, and the flooring, which are of wood, are composed of Papier-maché.—According to *The Inventor,* the front, back, and end of a house or building are made up of panels of a rectangular form, framed in wood, and externally covered with iron, plain or corrugated, and by preference galvanized; on the inside the frames of panels are covered with papier-maché, or thick paper, or wood, or other suitable material, the spaces between the inner and outer coverings—excepting so much as is occu-

pied by the framing—being air spaces, which will tend to keep the building warm. The panels go together by means of pilasters grooved to receive them. The parts of the ground-plate or framing go together in squares, and fix to each other by screws and nuts. The floor is made in parts of a square form, the boards being fixed to the joists and the ground plate; a frame being notched out to receive the joists. The upright panels enter between the floors and a fillet fixed to this ground-plate. The roof is made in rectangular parts by framing or connecting the rafters at top and bottom, so that when the parts of a roof are brought together, and are placed to the proper inclination, they are fixed by screws, and are retained from strutting by means of tie bars or rods. The frames of rafters are externally covered with iron (corrugated or plain), by preference galvanized; and where a horizontal ceiling is not to be used, then on the interior by papier-maché, wood, or other suitable material. The ceiling is likewise made in panels. The partitions are also made in panels, and go together by means of pilasters, in like manner to the ends, front, and back of the building; and in making partitions it is preferred to cover the frames with papier-maché on both sides; in this manner may partitions be made for the interior of ships or vessels; but other materials may be employed for covering the framed panels for the portable buildings.

ARTIFICIAL STONE.

Messrs. Julius Horing and Ludwig Suess, of New Jersey, have patented a process for the formation of Artificial Stone, in which they employ a compound of silex, alumina, and chloride of sodium. The mixture not only can be manufactured into blocks of Artificial Stone, but can be applied as a glaze to pottery-ware.

NEW PLASTIC MATERIAL.

Five parts of mixed whiting are mixed with a solution of one part of glue. When the whiting is worked up into a paste with the glue, a proportionate quantity of Venetian turpentine is added to it, by which the brittleness of the paste is destroyed. In order to prevent its clinging to the hands while the Venetian turpentine is being worked into the paste, a small quantity of linseed oil is added from time to time. The mass may also be coloured by kneading in any colour that may be desired. It may be pressed into shapes, and used for the production of *bas-reliefs* and other figures, such as animals, &c. It may also be worked by hand into models, during which operation the hands must be rubbed with linseed oil; the mass must also be kept warm during the process. When it cools and dries, which takes place in a few hours, it becomes as hard as stone, and may then be employed for the multiplication of these forms.—Prof. Purkinje: *Gewerbebl. aus Wuremb.*

INK FOR STEEL PENS.

Professor Runge has long sought to obtain an Ink which would not yield sediment, which should adhere to paper, resist the applica-

tion of acids, and have no action on steel pens. He has at length obtained a liquid of this kind, consisting only of Campeachy wood, chromate of potassa, and water. As it contains neither vinegar, gum, sulphates of iron and copper, nor galls, its cost is very moderate. The proportions are 500 litres decoction of Campeachy wood to 500 grammes chromate of potassa. The Campeachy wood is boiled in a sufficient quantity of water to form 80 litres ($4\frac{1}{2}$ litres = 1 English gallon) of decoction from 10 kilogrammes of wood, (about 20 lbs.) After the liquid is cool, the chromate is added, and the whole well stirred. The ink is then ready, and may be used at once. Any addition of gum would be injurious. It may appear strange that so little chrome should convert so large a quantity of decoction into ink; but the proportion must not be exceeded, as a larger amount would destroy the colouring matter. If, on the other hand, the proportions here given are observed, a blackish hue is formed from the yellow pigment of the wood. This is not a suspended precipitate, like the gallate of iron in common ink, but a true solution from which no sediment can be deposited. A paper written with this ink may be immersed in water for twenty-four hours without injury. Dilute acids do not destroy it, or change its tint. The pens used with this ink should be perfectly free from grease, and may for this purpose be cleaned by immersing them in ley of wood-ashes.—*Artizan.*

PERMANENT MURAL PAINTING.

THE desire to possess some means of preserving Mural Pictures from atmospheric influence, and of which fresco painting is still subject to decay, especially in northern climates, has been the cause of many experiments made of late, of which the Munich Stereochromy has been one of the principal. In the Paris Exhibition of Fine Arts, however, M. Devers, of Turin, a former pupil of Jollivet, Ary Scheffer, and Picot, has placed a large picture executed with enamel paste on burnt clay (*pâte d'émaîl sur terre cuite*). It is of large dimensions, $5\frac{1}{2}$ by $4\frac{1}{2}$ metres, and is composed of seventy-eight pieces. The brilliancy of this picture, representing "Three Guardian Angels watching the Sleep of a Babe," is great; still there is some inequality of colour in it, as the want of greater means prevented the artist from using an adequate furnace for baking the single tablets of clay; and he was unable to burn more than sixteen at a time, which operation he had to repeat with the whole three times over. The execution of this vast enamel has cost M. Devers one year's labour and an outlay of 10,000 francs. Stereochromy has been also used by M. Portaels on the walls of the Church of St. Jacques sur Caudenbreg, in Brussels. It is certainly a process more durable than the old Italian fresco. Still, it is to be supposed that stereochromy, as practised at Munich and Brussels, will not be able to compete with tablets which, like those of M. Devers, have been exposed three times to the action of fire in a furnace. Other analogous experiments have been made at the Church of St. Vincent de Paul at Paris, by M. Jollivet, who has executed his frescoes on tablets of lava from Volic. The latter are not subject, like those of baked clay, to warp by the influence of fire, and can be made of

a smoother surface. As, however, lava tablets are not to be obtained everywhere, the process of M. Devers deserves every trial and encouragement. Besides the painting in the Paris Exhibition, he has previously made similar pictures for the palace of the King of Sardinia and the Church of St. Leu in France.—*The Press newspaper*.

MUSEUM OF ORNAMENTAL ART, MARLBOROUGH HOUSE.

THE Museum in connexion with the Department of Practical Art has been enlarged. A case of jewellery, of considerable interest, has been added, and several fine specimens of metal work. Amongst the bronzes will be found all those produced by the Art-Union of London, and which have been mainly instrumental in advancing this branch of art in England. The largest increase of specimens, as it seemed to us, is in the section illustrative of pottery; and a very interesting and instructive section it now is, including the collection of the late Mr. Bandinell. The case containing specimens of English earthenware is very curious, and would afford matter for an amusing paper. The collection of Majolica ware is large and valuable, and will be looked at with more wonder by the uninitiated, if they obtain a notion of the sums of money which such works fetch. And what is Majolica ware, some of our readers may ask? It is too long a story to go into now, but we may say, in brief, that the term probably had its origin in the fact that painted pottery first came into Italy through the expedition against Majorca, in the twelfth century, when Moorish pottery formed part of the spoils. What we now know as Majolica ware proper belongs mainly to the fifteenth and sixteenth centuries. The earlier specimens of it are called mezza-Majolica. The finer ware was afterwards called "Porcellana," that being the Portuguese word for a cup. Majolica is sometimes termed Raffaelle ware, but improperly so. Raffaelle may have painted some of these pieces with his own hands, and it is quite certain that his compositions are found upon many of them; still the best works in this manufacture were not produced till after his death.—*Builder*, No. 557.

MR. FARADAY'S LECTURES FOR THE YOUNG.

THIS series of Lectures, delivered last season at the Royal Institution, was principally occupied with illustrations of the actionof the atmosphere upon carbon and hydrogen; and upon the lecturer concluding his remarks and experiments on that subject, the combustibility of sulphur and phosphorus was exhibited experimentally, and the experiments terminated with the action of oxygen on both substances. The importance of phosphorus as an element in the fabric of the human body, and its necessary presence in the vegetable kingdom, in order to replace animal waste, were dwelt on at great length, and illustrated by experiment. Sulphuric acid is now considered as the most energetic of what are termed the acid powers. To show the power of this substance, a blue liquid in a large bottle was by the application of one or two drops of the acid changed into a red one. With the same view were exhibited experiments showing the influence of sulphuric acid in destroying ammonia, and in charring wood. The lec-

turer then proceeded to speak of the metals, of which he chiefly desired to show the combustibility. Iron is a very combustible substance ; so combustible that but for one little circumstance the Crystal Palace would have burnt spontaneously, in consequence of the large share which iron had in its composition. The combustibility of zinc was then shown by experiment ; some shreds of that metal, in the form of a tassel, when placed in a jar of oxygen, burning like paper. The combustion of iron was illustrated by the friction of steel. Copper and tin were burnt at a small charcoal furnace. Antimony, after burning for some time at the same furnace, was thrown down upon a white frame which lay upon the floor, where it continued to burn in globules until it was consumed. A similar experiment was performed with iron. Such bodies as carbon, when burnt, produced substances of a volatile nature, which mingled with the atmosphere ; but as soon as burning metals had cooled they assumed a condensed and even solid form ; so that lead, for example, after being consumed, left behind it, in the form of oxide of lead, a substance weighing more than the original one.

Mr. Faraday illustrated these interesting subjects by a profusion of other experiments directed to their minor details ; and concluded by expressing the hope, so characteristic of his ardent devotion to the culture of philosophy, that what his juvenile hearers had heard might prove the foundation of an acquaintance with the science of chemistry.

NEW APPLICATION OF THE CENTRIFUGAL MACHINE, BY H. GRÜNEBERG.

A VERY ingenious application has been made of the Centrifugal Machine, now so largely employed in drying cloth, draining sugar, cooling worts, &c.: namely, to rapidly separate very finely divided precipitates of white lead suspended in water. This modification consists of a copper drum, tinned interiorly, and having a solid periphery instead of the wire gauze ones of the usual machines. In the bottom of the drum, which has a slight inclination towards the centre, is a draw-off cock ; and there are a number of partitions soldered on to the periphery, so as to divide the drum into a number of compartments, and thus prevent the circulation of the liquid during the rapid rotation of the machine. There is, of course, no external vessel, as there is no straining of the liquid through the side of the drum. In using it for white lead, it was two-thirds filled with milky fluid, and was then rotated at the rate of about 1000 times per second ; in ten minutes the whole of the precipitate was separated, and deposited as a thick paste on the walls of the drum, the liquid becoming perfectly clear, and may be drawn off by the cock.

There can be no doubt that such a machine could be employed with great advantage in the manufacture of colours, emery, and other polishing powders ; but perhaps its chief use would be in the manufacture of earthenware. The process at present followed in the English potteries to separate the excess of water in the manufacture of ground flint, china, clay, &c., and obtain them in a sufficiently plastic state to work them on the potter's wheel, is exceedingly unwholesome and very expensive.—*Journal für Praktische Chimie.*

NEW OIL FILTER.

M. Tard, of Paris, employs, to filter his oil, paper pulp mixed with from one-third to one-half its weight of beech sawdust, washed for several days, and then moulded into cakes. One of these, 9·8 inches in diameter, and 32·6 inches in thickness, and weighing about one pound, is capable, with a pressure of 13 feet of oil, of filtering 317 gallons in 24 hours.—*Polytechnische Zeitung.*

INSTITUTION OF CIVIL ENGINEERS.

The Council have awarded the following premiums:—Telford Medals to J. Coode, for his "Description of the Chesil Bank,"—D. Kinnear Clark, for his "Experimental Investigation of the Principles of Locomotive Boilers,"—W. A. Brooks, for his paper, "On the Improvement of Tidal Navigation and Drainage,"—J. B. Huntingdon, for his paper, entitled, "Observations on Salt Water and its application to the generation of Steam,"—H. P. Burt, for his paper, "On the nature and properties of Timber, with notices of several methods now in use for its preservation from decay,"—T. Duncan, for his "Description of the Liverpool Corporation Water Works,"—C. W. Siemens, for his paper "On the Conversion of Heat into Mechanical Effect,"—B. Cheverton, for his paper "On the use of Heated Air as a Motive Power,"—and J. Barrett, for his paper, "On the Construction of Fire-proof Buildings." Council premiums of books, suitably bound and inscribed, to J. Richardson, for his paper, "On the Pneumatics of Mines,"—W. G. Armstrong, for his paper, "On the Concussion of Pump Valves,"—R. Rawlinson, for his paper, "On the Drainage of Towns,"—and J. Sewell, for his paper, "On Locomotive Boilers."

SOCIETY OF ARTS.

On June 10, the Anniversary (also the Centenary) Meeting of this Society was held, Prince Albert in the chair. His Royal Highness said:—Ladies and gentlemen, three years have now elapsed since this Society last distributed its medals and awarded its prizes. The interruption that took place was owing to the Great Exhibition of 1851, which caused so much excitement and interest, and claimed such a large share of the public attention. The Society took so honourable a part in that great event, that it need not be ashamed to refer to it. I hope you will be convinced, from the works of art and new inventions which will be brought before you to-day, that the inventive genius, as well as the skill, of this country is making rapid strides—(Cheers). The Secretary read his report on the operations and position of the Society, and said that if a smaller number of prizes are now given than used to be the case, it is not because the Society is less able or less willing than it was formerly to reward merit; but because, from the altered spirit of the times, the encouragement and aid of the Society are less needed as a means of bringing forth isolated inventions and dormant talents, and are more urgently needed in the development of enlarged generalizations and comprehensive measures. The following is a list of the Prizes awarded:—

To Mr. Joshua Rogers, 133, Bunhill Row, for his Shilling Box of Water Colours—the silver medal.

To Mr. John Cronmire, 10, Cottage Lane, Commercial Road East, for his Half-crown Box of Mathematical Instruments—the silver medal.

To Mr. James Taylor, of Elgin, for his Essay on the Cotton Manufactures of India—the Isis medal.

To Mr. Henry Weekes, A.R.A., for his Essay on the Fine Arts Department of the Great Exhibition—the silver medal.

To Mr. F. C. Bakewell, for his Essay on the Machinery of the Great Exhibition—the silver medal.

To Dr. Robinson, of Newcastle, for his Improved Safety Lamp for Miners—the thanks of the Society.

To Mr. R. G. Salter, for his Method of Flushing Sewers—the silver medal.

To Mr. Jonas Bateman, for his Improved Life Boat—the thanks of the Society.

To Mr. William Clerichew, of Ceylon, for his Improvements in the Curing of Coffee—the Isis gold medal.

To Mr. V. Vaughan, of Maidstone, for his Machine for putting up Chimney-pieces—the silver medal.

To Admiral Sir Henry Hart, of Greenwich, for his mode of Curing Smoky Chimneys—the Isis medal.

To Mr. J. Rock, jun., of Hastings, for his New Carriage Spring—the Isis medal.

To Dr. Stolle, of Berlin, for his Essay on the Manufacture of Sugar—the thanks of the Society.

To Dr. Cumin, of Bath, for his Specimens of Paper from Sugar Cane Refuse—the thanks of the Society.

To Mr. W. Bollaert, for his Essay on the Use and Preparation of Salt—the Society's medal.

To Mr. H. Owen Huskisson, for his Essay on the Use and Preparation of Salt—the Society's medal.

To Mr. John Dalton, of Hollingworth, for his Double Register Calico Printing—the Society's medal.

To Mr. G. Scholes, of Landport, for his Slide Motion Indicator—the Society's medal.

To Mr. G. Edwards, for his Improved Portable Photographic Camera—the Society's medal.

To Mr. J. Toynbee, F.R.S., for his Artificial Membrana Tympani—the Society's medal.

To Mr. W. Wood, for his Improved Method of Teaching Music to the Blind—the Society's medal.

To M. A. Claudet, for his Essay on the Stereoscope, and its application to Photography—the Society's medal.

To Mr. Joseph Hopkins, of Worcester, for his mode of giving Equatorial Motion to Telescopes—the Society's medal.

To Mr. G. Jennings, for his Improvements connected with the drainage of Houses—the Society's medal.

To Mr. H. J. Saxby, of Miletown, Sheerness, for his new Lock—the Society's medal and 10*l*.

To Mrs. A. Thomson, of New Bond-street, for Four Drawings in Outline—the Society's medal.

To Mr. W. Stones, of Queenhithe, for his Essay on the Manufacture of Paper—the Society's medal.

To Mr. C. Shepherd, jun., of Leadenhall Street, for his Improvements in Electric Clocks—the Society's medal.

To the Rev. W. T. Kingsley, of Cambridge, for his Discoveries in Photography—the Society's medal.

To the Very Rev. the Dean of Hereford, for his Essay on Self-supporting Schools—the Society's medal.

To Dr. Lloyd, of Warwick, for his Samples of Paper made from the Refuse of Cowhouses—the thanks of the Society.

To Professor Jack, of New Brunswick, for his Essay on the Decimal System of Weights and Measures—the thanks of the Society.

To Mr. James Hole, of Leeds, for his Essay on the History and Management of Literary, Scientific, and Mechanics' Institutions—the Society's medal and 50*l*.

Natural Philosophy.

THE TRIGONOMETRICAL SURVEY.

A COMMUNICATION has been read to the British Association, from Lieut.-General Sir John Burgoyne, Inspector General of Fortifications, regarding the Progress made in the Publication of the Trigonometrical Survey, by Colonel Sabine. The labours of the Ordnance Survey Department have been directed, during the past year, to the determination, according to the theory of minimum squares, of the most probable corrections to be applied to the angles of the principal triangles. This process, which is a most laborious one, involving the solution of about 1300 equations of condition, is now well advanced, and every exertion is being made to hasten its completion. Until it has been finally completed, the computations of distances cannot be properly undertaken, for it must be borne in mind, that the trigonometrical operations of the Ordnance Survey have not been limited to the measurement of solitary arcs of meridian, but embrace a connected triangulation, extending through the length and breadth of the United Kingdom, which must be considered as a whole in deducing the geodetic results to compare with the astronomical observations. Besides preparing for the publication of the Principal Triangulation, the Ordnance Survey Department are about to publish a volume of Levels in Ireland, and another of the Meteorological Observations made at the Ordnance Survey Office, near Dublin—the printing of both works being at the present time in progress.

"PERPETUAL MOTION."

THERE have been read to the Scottish Society of Arts "Some Notices of Attempts to Discover Perpetual Motion," by Daniel Wilson, LL.D., V.P. A curious collection of models, executed by various ingenious pursuers of the mechanical fallacy of perpetual motion, was exhibited, and Dr. Wilson gave some account of R. Aird, an indefatigable enthusiast, the constructor of several of the models. After pointing out the arguments by which the theory of Perpetual Motion was demonstrable as an impossibility, he remarked that there was one light in which the aim of such attempts might be viewed, which, though curious, he was not aware had yet been noticed. The attempts to endow dead matter with a self-originating and self-sustaining principle of motion, was, in other words, an attempt to *create life.* If the theory of a perpetual motion in mechanics was possible, then its execution, or even the demonstration of its possibility, amounted to the most practical establishment of materialism that could be conceived; and the idea of a self-originating universe would no longer be open to dispute.

ASCENT FROM THE CENTRE OF GRAVITY.

A PAPER has been read to the Scottish Society of Arts, by Mr.

John Campbell, "On the Principles of Ascent from the Centre of Gravity," this being preliminary to another communication by the same author, "On the Cause of Upright Movement or Ascent from the Centre of Gravity, illustrated by the Antilunar Line." Mr. Campbell stated that the theory of the tides formed no part of the Newtonian philosophy. That which was now established in the British schools was contained in a paper written by Professor John M'Laurin, whose theory was, that the lunar tide was caused by the waters being drawn by the moon's attraction from the earth, and the antilunar tide by the earth being drawn from the waters. There was no difficulty as to the lunar tide; all were agreed that the moon attracted the earth; and as attraction increased and diminished inversely as the squares of the distance, the waters at the equator were more attracted than the waters at the centre and the poles, and, therefore, they arose into a tide. With regard to the antilunar tide, Mr. M'Laurin stated, that in consequence of the increasing distances between the moon and the lunar and antilunar equator, the earth would form a spheroid, whose longest axis would be in the line of the moon. For this theory the author proposed to substitute the following—that the lunar tide was produced by the waters nearest the moon being more attracted at the equator than at the poles; and the antilunar tide, by the waters at the poles being more attracted than those at the equator; and being resisted by the beds on which they rested, those that were most attracted displaced those that were least attracted, and compelled them to ascend and accumulate into a tide.

APPLICATION OF THE PENDULUM TO THE DETERMINATION OF VELOCITIES.

(Translated for the *Mechanics' Magazine*, No. 1356, from M. De Boucheporn's paper, read before the French Academy of Sciences.)

In everything that concerns navigation, the importance of such an object will be immediately perceived. There exist, indeed, several precise and convenient means of measuring the speed of trains on railways,—for example, where the point of support between the wheel and the rail remains fixed (as distinguished from slipping), it is sufficient to be able to assign the rapidity of rotation of the wheels. But at sea the case is very different. The sea is subject to currents, of which the extent, the direction, and the velocity are never but imperfectly known. The sustaining point is thus itself transported in one direction or the other; and the log, the only elementary and non-astronomical means of measuring the speed of ships, gives, under any circumstances, only the difference between it and that of the surface of the water. On the contrary, it is possible to ascertain the real speed of the vessel by the indications of the pendulum, of which I am about to endeavour to explain the principle.

Suppose that a pendulum beating, say half-seconds, and carrying a bob weighing a few grammes (a gramme is equal to 15·44579 grains Troy), be suspended in such a manner that its plane of oscillation may be parallel to the axis of progression of the vehicle. If the

pendulum be vertical, the bob and the point of suspension being subjected to the same velocity, it would remain in the same state for an indefinite period, making abstraction of irregularities of motion, and derangements of various kinds. But if, by a small impulsion given by the hand in a direction contrary to that of the motion of the vehicle, the bob be made to recede a little from the vertical, the velocity of the point of suspension then produces upon it a tractive force through the instrumentality of the rod, which has become inclined to the horizon. That traction has a horizontal component, and ought, consequently, to draw forward the centre of the little mass, with a force proportionate in its intensity to the speed of the vehicle. In falling back again, and after having retrogressed a little behind the vertical, as soon as the obliquity of the rod has become sufficient, the same traction will exert itself anew, and the bob will recommence the same oscillation forwards, under the influence of the two forces of traction and gravity. Without knowing precisely the law of these two combined actions, we may nevertheless conjecture that the pendulum, under these circumstances, would take a deviation forwards, great or small in proportion to the velocity of traction, and remaining sensibly constant if the same speed were maintained. An experimental graduation might then teach how, for a pendulum of given length and weight, to measure the speed of the vehicle on which it was carried, by observing its deviation in front of the vertical.

Such is the principle on which I have reflected, and which I have desired to subject to experiment; to recognise, in the first place, its reality, and then the possibility and the sensibility of a measure so contrived. Moreover, it is very easy to obtain this verification by an experiment to some extent manual,—I not having been able, as yet, notwithstanding several attempts, to construct an apparatus capable of going by itself continuously, and destroying the effect of the various kinds of derangements and irregularities which the hand can extinguish. I do not attempt in this place, therefore, to give an exact measure of the phenomenon, but only to prove the principle of it by an experiment easily reproduced; and which, from being deprived of elegance, is not in substance less decisive.

If we get into a railway-carriage, and resting our arm against a vertical support, hold a pendulum suspended in connexion with the graduated arc of a circle, in conformity with the conditions indicated above, and if, with a proper amount of attention, we preserve this instrument as much as possible from the effect of lateral shocks and vertical movements, we may observe the following result:—We shall hardly have given to the bob a slight retrograde impulse, than, under the influence of traction, we shall see it almost immediately spring forwards through an angle which, for an ordinary speed of 28 miles an hour (10 *lieues*), will soon increase to about 33 degrees. In falling back, on the contrary, the backward deviation is hardly 5 or 6 degrees, and the same motion continuing so long as the velocity lasts, there is thus a very considerable and permanent inequality between the two branches of the oscillation. This is, in some degree, the

characteristic part of the phenomenon. If, in this state of things, the velocity of traction should diminish, the direct deviation diminishes nearly as rapidly; and I have never failed, in experimenting in this manner, to become aware of my approach to a station, without taking my eyes off my pendulum.

The inequality between the two branches of the oscillation is also sensible for inferior velocities, for less than 28 miles an hour, and we still see the pendulum advance 10 degrees before the vertical. The rate of ships being ordinarily comprised between 6 and 18 miles per hour (2 and 6 *lieues*), the variations of amplitude corresponding to such velocities have a very appreciable sensibility. That sensibility besides is susceptible of augmentation, by varying the length or the weight of the pendulum. I am not able at present, however, to say anything certain on the subject. It is clear that there must be certain dimensions which will belong to the maximum of effect; but as to that, experiment does not always bear out suppositions of a complicated and difficult nature, and it is experiment that will have to pronounce.

If we wish to arrive at true precision in the kind of measure of which I have been speaking, the great and real difficulty lies evidently in the construction of apparatus capable of protecting the point of suspension of the pendulum, whether from jerkings and shocks on a railroad, or, above all, from the pitching and rolling of a ship. It is upon this point that my researches are being directed. Already I have made some attempts, and it was to try to combine these several dispositions that I sought to improve our prospects, as regards time, by this communication. Perhaps it never will be possible to obtain an apparatus of continuous action, nor an apparatus capable of working independently of the manual address of the operator. But many very useful instruments are precisely in the same condition; and with regard to continuity, it will be sufficient for me to call to mind, that in ships in motion it is only customary to throw the log three or four times a day. If, however, we should only succeed in affording the means of measuring speed in calm weather, in an intermittent manner, and even under conditions essentially manual, but with a light instrument, of elementary simplicity, easy to construct and to repair, I think we shall have attained an end of unquestionable utility; and it is the hope of that result that attaches me to the prosecution of this research.

STANDARDS OF LENGTH AND WEIGHT.

It will be remembered that the destruction of the Houses of Parliament by fire, in 1834, proved fatal to the Standard Yard and Pound. A Commission was subsequently appointed to consider the steps to be taken for the restoration of these standards—the members of which were all Fellows of the Royal Society.

The late Mr. Baily took a very active part in the preparation of a Standard Yard; which, however, although constructed most carefully, deteriorated in such a manner as to be unworthy of confidence. Since Mr. Baily's death, the Rev. Mr. Sheepshanks has been engaged on

the very difficult and delicate task of constructing a standard yard—while Professor Miller, of Cambridge, undertook to make a standard avoirdupois pound. The liberality of Government placed at Mr. Sheepshanks's command apparatus for his purpose far superior to that possessed by his predecessors. His labours were carried on in the lower tiers of cellars in Somerset House—which are very favourable to the work, on account of their slow-changing temperature.

After an infinite number of experiments and comparisons, two standards have been constructed. The originals have been inclosed in one of the walls of the New Houses of Parliament;—and perfectly accurate copies have been placed by Mr. Airy in the custody of the Royal Society.

The standard yard measure is defined by the interval between two lines upon a bar of gun-metal. The bar is about thirty-eight inches long and one inch square; it is supported in a horizontal position upon eight brass rollers, which are carried by levers so arranged that the pressures upon the eight rollers are necessarily equal. The lever frame, with the bar resting upon it, is placed in a box of mahogany wood. The bar is prevented from moving endways by weak brass springs attached inside to the ends of the box, and is prevented from moving upwards by wedges of paper placed under three inverted stirrups. Near to each end of the bar, a cylindrical hole is sunk from the upper surface of the bar to the depth of half an inch; and at the bottom of each cylindrical hole is inserted a gold pin, upon which are cut three fine lines in the direction transversal to the bar, and two fine lines parallel to the axis of the bar. The limiting points of the yard measure are those points of the middle transversal lines which are midway between the longitudinal lines. On the upper surface of the bar the following inscription is engraved:—

Copper	16 oz.
Tin	$2\frac{1}{2}$
Zinc	1

Mr. Baily's metal.

Standard yard at 62°10, Fahrenheit, cast in 1845. Troughton & Simms, London.

It is necessary to observe that, although the bar was cast so long ago as 1845, the standard yard has been completed only very lately.

The standard pound weight is made of platinum, representing, when weighed *in vacuo* against the last standard Troy pound, 6999·9975 grains—of which the last standard contained 5760 grains. The form of the weight is a cylinder, with a groove surrounding it a little above the middle of its height for the insertion of the fork which is used in lifting it. On the upper end of the cylinder is engraved the following inscription:—

No. 2.
P.C.† 1844.
1 lb.

The box containing the weight is mahogany—and when its portions are screwed together, the weight is fixed immovably. This mahogany box is placed in a second mahogany box, the lid of which bears the inscription—

Standard Pound, 1853.

The mahogany boxes of the yard and the pound are inclosed in an oak box, upon whose lid is cut and painted the inscription—

British Standards of Length and Weight, 1853.

Athenæum, No. 1356.

CRYSTALLINE FORM OF THE GLOBE.

M. DE HAUSLAB, in a recent publication, after discussing the direction of mountains, and of dikes and of cleavages among rocks, deduces some general principles with regard to their direction, and then explains his hypothesis that the surface of the Globe presents approximately the faces of the great octahedron. In an octahedron there are three axial planes intersecting one another at right angles; and the positions of the circles on the earth's surface, which are laid down as the limits of these planes (or their intersection with the surface), are as follow. The first circle is that of *Himalaya and Chimborazo*, passing from Cape Finisterre to the Himalaya, Borneo, eastern chain of New Holland (leaving on its sides a parallel line in Malacca, Java, and Sumatra), to New Zealand, thence to South America, near Chimborazo, the chain of Caracas, the Azores, to Cape Finisterre. The *second* passes along the South American coast, and the north and south ranges of the Andes, the mountains of Mexico, the Rocky Mountains, Behring's Straits, the eastern Siberian chains, going to the south of Lake Baikel, the Altai, Himalaya, the mountains of Bombay in Hindostan, a point in the north-east of Madagascar (where the summits are 12,000 feet high), the mountains of Nieuwedfeld, 10,000 feet high, Cape Caffres, to Brazil, the rapids of La Plata, Paraguay, Panama, the elevated basin of Titicaca, the Andes, Illimani, and the defile of Maranova. The *third* circle cuts the two preceding at right angles, and passes by the Alps, the islands of Corsica and Sardinia, along the basin of the Mediterranean, the mountains of Fezzan, Lake Tchad, the Caffre mountains of Nieuwedfeld, the Southern Ocean, near Kerguelen's Land, the eastern or Blue Mountains of New Holland, Straits of Behring, Spitsbergen, Scandinavia, Jutland, &c.

These three great circles point out the limits of the faces of the great hypothetical octahedron. Each of the faces may be divided into eight others by means of lines of accidents of minor importance, so as to make in all forty-eight irregular triangles, a form of the diamond. At the intersections, M. de Hauslab observes that there are nodes of dikes; and along the lines, or near them, all the mountains of the globe occur. The author gives an extended illustration of his subject, and afterwards considers the particular history of the configuration of the earth's surface in accordance with his hypothesis.

M. Boue, who adopts similar views, adds as a note, that we should remember in this connexion that the metals crystallize either in the tesseral or rhombohedral system, and that native iron, the most common constituent of meteorites, is octahedral in its crystals.—*Jameson's Journal*, No. 109.

MAGNETISM OF ROTATION.

A PAPER has been read to the British Association, "On the Magnetism of Rotation in masses of Crystallized Bismuth," by M. Matteucci. The apparatus used by the author consisted of an electro-magnet caused to revolve by clockwork; and the body to be submitted to the action of the electro-magnet was suspended between its poles. Sometimes he suspended it by a fine silver wire, and determined the force of torsion, when equilibrium took place, the body being usually suspended in water to check its tendency to vibrate. Sometimes he used a single thread of cocoon silk, and the forces developed were measured by counting the number of uniform rotations which took place in a given time. The author first describes certain preliminary experiments which he made with this apparatus. He suspended solid spheres of copper, and hollow spheric shells, of exactly the same diameter, formed by the electro-plate process, between the revolving poles, and measured the force by torsion. With a full sphere weighing 59·80 gr., and a hollow one weighing 10·85 gr., he found the torsions in the proportion of 1 : 0·71. With spheres of a less size the differences were less than these. The author concludes from this that the internal shells of metal, on which the induced forces are less, serve to discharge the currents developed in the exterior shell; and that an analogous effect shows itself in many other cases of magnetism of rotation. The author also submitted to the same apparatus a cube, formed of very thin square laminæ of copper, insulated from each other by layers of varnish; when this cube was suspended a few centimètres above the electro-magnet, so as to have its constituent laminæ horizontal, it experienced no action from the magnet; but when its laminæ were vertical it received a very rapid motion of rotation:—in this latter case the currents induced having the power to develop themselves freely, and circulate on each lamina, which cannot take place in the former case. In his experiments with crystallized bismuth compared with amorphous masses of the same substance, he found:—1. That the forces developed by the revolving electro-magnet are greater for the amorphous masses of bismuth than for the crystallized metal. 2. That the forces developed in the masses of crystallized bismuth are greater when the cleavages are disposed vertically and perpendicularly to the planes of the currents of the electro-magnet than when these cleavages are placed horizontally.—*Athenæum*, No. 1153.

MAGNETIC PHENOMENA IN YORKSHIRE.

PROFESSOR PHILLIPS has communicated to the British Association, a paper, the object of which was to state some few remarkable results touching the measures of Magnetic Direction in Yorkshire; and some investigations which were intended to show the relation of the change in the direction of the lines which represented numerically the features of the physical geography of the district. Observations which had been made by him at York, during a residence of nearly a quarter of a century, showed, in regard to the declination or variation of the compass, or the angle between the true and magnetic

meridians, that in that time it did not exceed ten minutes of angle. It was now at York 24 deg. 5 min., and at the beginning of his observations was 24 deg. 15 min. He did not mean to say that this observation was perfectly accurate, but it was within two or three minutes of angle. He had also taken particular pains to ascertain the magnetic dip and inclination. This, as measured from the horizontal line in the plane of the meridian, is at this time a little above 70 deg., and appears to be slowly but unsteadily diminishing. His first accurate observations on this subject were commenced in 1837, when he obtained that beautiful instrument, Mr. Charles Robinson's dip circle. With this instrument he has surveyed the country, and determined the magnetic dip at stations by a series of observations. After reciting the nature of these observations and the computations which had been made upon them, a diagram was shown, in which a straight line, AB, represented the result of this computation. It passes through the three calculated mean points and near to all the others, and indicates an annual diminution of the dip of 2 min. 54 sec., a result only somewhat different from that found in 1847, by Colonel Sabine, for Britain, and Dr. Lloyd, for Ireland. To make this result perfectly accurate, it should be corrected for any periodical deviations from the mean of the year, to which the particular months or the particular hours where the observations were made might be subject. The data for this, however, he had hardly sufficiently ascertained, but from the Greenwich observations it appeared probable that the magnetic dip has in each year a maximum about the months of May and June, and a minimum in the autumn. The Professor then exhibited maps, having marked upon them the isoclinal lines of Yorkshire, which he had obtained on the graphic projection, and by the calculation known as least squares. From these maps it appeared that, on the eastern hills of Yorkshire, the isoclinal lines required to be drawn to the northward. In the vale of York they required to be drawn rather to the southward; while, to the westward, the lines would run nearly parallel with the meridional line. With respect to the general conclusions arrived at, he remarked that magnetic and diamagnetic effects on a suspended needle ought probably to be looked for as a simple consequence of the superposition and strata, and their pressure on one another. Looking at what had been done with magnetism, and considering what had been stated by Colonel Sabine, that the moon as well as the sun had effects on magnetism, he must say that he thought the day would come when we should be able, by magnetism, to arrive at the nature of those substances beneath the thin crust of the earth's surface, and that over the red sandstone of England we should be able to see into the condition of coal measures without actually making a perforation.—*Ibid.*

MAGNETIC AND DIAMAGNETIC INDUCTION.

Professor Plucker, of Bonn, has read to the British Association a paper on "The New Laws of Magnetic and Diamagnetic Induction." The communication related to the transition from magnetic attraction into diamagnetic repulsion, which takes place on mixed

bodies when the power of the magnet increases. He had deduced, from a long series of facts, that by increasing this power the action on diamagnetic power augments more rapidly than the action on magnetic ones. This, however, had not been generally adopted; and last summer he had undertaken a series of experiments, which would give, he thought, to that law a more universal character and a more distinct description.

MOORE'S PATENT SPHERICAL OR GREAT CIRCLE INDICATOR.

THIS instrument is another and a great step towards simplifying that most troublesome, but most important, problem of Great Circle routes. It consists of four graduated circles of 11 inches diameter, two of which, arranged in opposite planes, represent a meridian and the equator, and over these two others, by a most ingenious arrangement, are made to revolve in every direction, so that by two attached compasses, or graduated circles, every element of spherical trigonometry can be readily ascertained by inspection, to a great degree of accuracy; a process also adapted to those problems necessary in nautical astronomy. Without comparing it with other facilities for working spherical sailing, which have lately appeared, it will be an acceptable assistant to those who are now beginning to see the necessity of adopting every facility for the greatly increased range of commerce. It is believed that in a few years this system will again resume its place, which the projection invented by Mercator and Wright has quite kept out of view for so many years.

DEEP OCEAN SOUNDING.

THE American Government surveying brig, *Dolphin*, empowered under an Act of Congress, in connexion with the scientific researches of Lieutenant Maury,* of the National Observatory at Washington, for the purpose of entering into a series of meteorological observations and discoveries, has completed a perfect line of soundings across the Atlantic to Rockule, off the west coast of Scotland. The distances between each place of sounding averaged about 100 miles. A line was then run to the Azores, to the north of which, about a parallel of forty-five in a south-west direction, an elevation was discovered on the bottom of the ocean of about 6000 feet, the soil indicating a fine yellow chalky substance mixed with a small portion of the finest sand. After leaving the Azores, the *Dolphin* took a westerly direction, still succeeding in discovering bottom. Steering north, she made a direct line to the "three chimneys," where, at a depth of 1900 fathoms, bottom was also discovered. At this point Lieutenant Berryman, in charge of the ship, finding the state of the weather unfavourable to a continuation of their research, made sail, and came into Southampton. The greatest depth at which bottom was reached was 3130 fathoms, in lat. from 41 to 43, lon. 51 to 56. The explorers

* On April 23, 1853, Lord Wrottesley, in the House of Lords, called attention to a correspondence between the United States Government, the British Government, and the Royal Society, in reference to Lieutenant Maury's scheme; which, however, had been previously adopted by the Dutch Government.

brought home with them specimens of the soil which had been discovered at their various places of sounding, to be laid before a committee of scientific men at Washington, for the purpose of analyzation. The temperature of the water was also tested at various depths, specimens of which have been preserved. During the whole of the observations, particular attention was paid to the width, depth, and force of the currents in different parts of the ocean, all of which have been carefully noted, for the purpose of being fully discussed and explained. There is one interesting matter in connexion with this subject, and the non-existence of which has been the great drawback to all previous results being satisfactory—namely, the very simple method by which the sounding apparatus is rendered entirely perfect and useful. In all previous attempts the great puzzle has been how to get back the weight when it has once reached the bottom; and it is a well-known fact, especially amongst seamen, that in deep-sea sounding, however carefully or strongly a line may be made, it never has, after being once sunk, been recovered. In this plan, however, the weight, upon its reaching the bottom, becomes immediately detached, and the line, therefore, drawn in with perfect ease. The plan is this:—A hole is drilled through a 64-lb. or heavier shot, sufficiently large to admit a rod of about three-quarters of an inch in diameter. This rod is about 12 or 14 inches in length, and, with the exception of about $1\frac{1}{2}$ inch at the bottom, perfectly solid. At the top of the rod are two arms extending one from each side. These arms being upon easily acting hinges, are capable of being raised or lowered with very little power. A small branch extends from the outside of each of them, which is for the purpose of holding by means of rings a piece of wire by which the ball is swung to the rod. A piece of rope is then attached by each end to the arms, to which again is joined the sounding line. The ball is then lowered into the water: upon reaching the bottom the strain upon the line ceases, and the arms fall down, allowing the ball to detach itself entirely from the rod, which is then easily drawn in, the drilled portion of which is discovered to be filled with a specimen of that which it has come in contact with at the bottom. There are other advantages also in connexion with the invention, which are of great utility in carrying out the discoveries; and which no doubt will so materially assist the scientific researches of the world, that the subject of whether there is or is not a bottom to the sea will no longer remain a difficulty to answer.

DEEP-SEA SOUNDING. BY CAPTAIN DENHAM.

Capt. Denham has communicated to the Royal Society, "An Account of a Deep-sea Sounding in 7706 fathoms, in 36° 49′ South Latitude, and 37° 6′ West Longitude."

This sounding was obtained on a calm day, October 30, 1852, in the course of the passage of H.M.S. *Herald* from Rio de Janeiro to the Cape of Good Hope. The sounding-line was $\frac{1}{10}$th of an inch in diameter, laid into one length, and weighing, when dry, 1 lb. for every hundred fathoms. Captain Denham received from Commodore

McKeever, of the United States Navy, commanding the *Congress* frigate, a present of 15,000 fathoms of line, 10,000 fathoms on one reel, and 5000 on another; he considers it to have been admirably adapted for the purpose for which it was made and to which it was applied. The plummet weighed 9 lbs., and was 11·5 inches in length, and 1·7 inch in diameter. When 7706 fathoms had run off the reel, the sea-bottom was reached. Captain Denham states that Lieut. Hutcheson and himself, in separate boats, with their own hands, drew the plummet up fifty fathoms several times; and after it had renewed its descent, it stopped, on each occasion, abruptly at the original mark to a fathom, and would not take another turn off the reel. The velocity with which the line run out was as follows:—

	h.	m.	s.
The first 1000 fathoms in	0	27	15
1000 to 2000 fathoms in	0	39	40
2000 to 3000 fathoms in	0	48	10
3000 to 4000 fathoms in	1	13	39
4000 to 5000 fathoms in	1	27	6
5000 to 6000 fathoms in	1	45	25
6000 to 7000 fathoms in	1	49	15
7000 to 7706 fathoms in	1	14	15
	9	24	45

The whole time, therefore, taken by the plummet in descending hrough 7706 fathoms, or nearly 7·7 geographical miles of 60 to the degree, was $9^{h}\ 24^{m}\ 45^{s}$. The highest summits of the Himalaya, Dhawalagiri and Kinchinginga, are little more than 28,000 feet, or 4·7 geographical miles above the sea. The sea-bottom has, therefore, depths greatly exceeding the elevation of the highest pinnacle above its surface.

The strength of the line tried before the sounding was found to be equal to bear 72 lbs. in air. The 7706 fathoms which ran out, weighed, when dry, 77 lbs., exclusive of the plummet, 9 lbs. Great care was taken in the endeavour to bring the plummet again to the surface to show the nature of the bottom; but, whilst carefully reeling in, the line broke at 140 fathoms below the water-line, carrying away a Six's thermometer which had been bent on at 3000 fathoms.—*Proceedings of the Royal Society.*

INSTRUMENT FOR TAKING SOUNDINGS.

Mr. F. Maxwell Lyte observes, in No. 40 of *The Philosophical Magazine:* There seems to be some difficulty about obtaining a correct sounding in places where the currents are strong and flow in different directions at the different points of depth, causing the line to assume different curves in its descent; and when it comes to be measured over, after the weight has reached the bottom and been hauled up again, the measurement gives no approximate idea of the real depth. Now it is plain that this mensuration of the depth of water might be as well made by estimating its vertical pressure, as,

in measuring the height of mountains, we measure the barometrical pressure of the air; and so I would propose to do it by an instrument constructed as follows :—

An accurately constructed tube of gun-metal or brass, or some metal not very easily corrodible by salt water, has a glass tube fitted on to it on the top by a screw joint, and again on the top of the glass tube is fitted a strong hollow copper ball by a similar screw joint. The lower tube has a well-turned piston fitted to it, from which runs a rod which is only a trifle longer than the tube, and just enters the tube when the piston is at its lowest point. A well-made spring is placed in the tube above the piston; and the tube being narrowed at the top, so as just to admit the free passage of the rod, and the rod having a little button at its top, the piston is kept at its lowest point by the spring, except when sufficient pressure is applied from below to compress the spring. The glass tube has a small ring fixed in it, just so as to stick at any point to which it is pushed; the button at the top of the rod serves to push the ring straight; and the ring thus forms an index of the degree to which the spring has been compressed. The ball on the top serves as a mere reservoir of air to equalize the action of the apparatus as much as possible. The whole of this apparatus is enclosed in a wire cage for the sake of protection from blows. To graduate this apparatus, I let it down in a known depth of water, say ten fathoms, and having observed the point to which the ring in the glass tube is pushed, and having marked this point off, the ball is to be unscrewed, and with a small ramrod the ring is to be pushed down till it rests on the top of the piston-rod. The ball being replaced, the apparatus is sunk in twenty fathoms; after a similar manner it is sunk in thirty, and next in forty fathoms. This will test the accuracy of the apparatus; and the marks made on the glass tube after each trial will give a scale from which the whole tube may be graduated, even to thousands of fathoms, if the tube be long enough, or the spring strong enough.

CURRENTS IN THE ARCTIC SEAS.

Dr. Sutherland, in concluding a paper read to the Royal Society, observes, that he does not know that we are yet in a position to demonstrate the actual existence of currents *into* the icy seas, as well as *out* of them; but that the necessity for them is obvious. It is not necessary, he remarks, that these currents, as in other parts, should occupy the surface, and probably also the bottom of one of the sides of the basins whose waters require to be renewed, as the Gulf-stream occupies the east side of the North Atlantic. It is plain that the cold and hot waters of two regions can be exchanged by the latter passing underneath the former; and although the Arctic current from the Greenland Sea does not contain much ice to the southward of Cape Farewell, it is more than probable its chilly waters pass over a fork of the Gulf-stream, which ultimately sweeps along the shores of West Greenland.

TEMPERATURE AND CURRENTS OF THE NORTH ATLANTIC AND NORTHERN OCEANS.

Dr. Scoresby has communicated to the British Association, his observations on the "Surface Temperature, and Great Currents of the North Atlantic and Northern Oceans." The observations generalized upon by the author had been derived from the temperature of the ocean, chiefly at the surface—had been made in the Greenland Sea, the North Sea, and a considerable belt across the North Atlantic, during a series of passages chiefly by sailing vessels between England and New York. Dr. Scoresby directed the present attention of the Section to the observations made in the last three localities. Of the passages just noted, sixteen in number, four were performed by the author, and twelve by an American navigator, Captain J. C. Delano, an accurate scientific observer. The observations on Surface Temperature discussed amount to 1153, gathered from about 1400. Usually Captain Delano recorded six observations each day during the voyage, at intervals of four hours. Seven of the passages were made in the spring of the year,—two in the summer,—one in the autumn,—and three in winter. Taking the middle day of each passage, the mean day at sea was found to be May 18th or 19th,—a day fortunately coincident in singular nearness with the probable time of the mean annual oceanic temperature. The author had laid down the tracks of the ship in each of the voyages on a chart of Mercator's projection, and the principal observations on Surface Temperature were marked in their respective places. The observations were then tabulated for meridians of 2° in breadth, from Cape Clear, longitude 10° W., to the eastern point of Long Island, longitude 72° W.—embracing a belt of the average breadth of 220 miles, or a stretch of about 2600 miles across the Atlantic. The results were the following:—1. Highest Surface Temperature northward of latitude 40°, 74°; lowest 32°; range 39°.—2. Mean Surface Temperature, as derived from the means of each meridional section, 56°, whilst the mean atmospheric temperature for the corresponding period was 54°·2.—3. Range of Surface Temperature within each meridional section of 2°, 8½° at the lowest, being in longitude 20-22° W., and at the greatest 36°, being within the meridian of 62-64° W.—4. Up to longitude 40° the Surface Temperature never descended below 50°; the average lowest of the sixteen meridional sections being 51°·88, and the average range 11°·3.—5. In the succeeding fifteen sections, where the lowest temperature was 32°, the average lowest was 37°·1, and the average range 29°·7. This remarkable difference in the temperature of the eastern and western halves of the Atlantic passage, the author said, was conclusively indicative of great ocean currents, yielding a mean depression of the lowest meridional temperature from 51°·88 to 37°·1, or 14°·8, and producing a mean range of the extreme of temperature on the western side of almost thrice the amount of the extremes on the eastern side,—or, more strictly, in the proportion of 29°·7 to 11°·1. The author drew attention to a diagram in which he had laid down along the entire belt, curves showing the whole

range of the lowest depressions of temperature and highest elevation, with the means at each longitude distinguished by different shading; and pointed out how the inspection of this as well as of the tabulated results, affords striking indications of the two great currents, one descending from the Polar, the other ascending from the Tropical regions, with their characteristic changes of cold and heat. In classifying the results, the author considered the entire belt of the Atlantic track of the passages as divided into six divisions of 10° of longitude each, and these into meridional stripes of 2° each, omitting the two first degrees next the European end, or about 80 miles westward of Ireland to 72° W., or about the same distance west of New York. To each of these six divisions he directed attention, pointing out the conclusions to be derived from each. The curves approaching each other and running nearly parallel through the western half with great regularity, showing the variations and range to be much less, while throughout the eastern half, the widening of the distance, and the irregular form of the extreme curves, showed the influence of the two currents very remarkably.

Dr. Scoresby then drew conclusions, showing that sometimes the cold current from the north plunged beneath the warmer current from the south. Sometimes they divided,—the colder keeping in-shore along the American coast, the other keeping out, and forming the main Gulf-stream. Sometimes where they met, they interlaced in alternating stripes of hot and cold water; sometimes their meeting caused a deflexion,—as where one branch of the Gulf-stream was sent down to the south-east of Europe and north of Africa, and another branch sent up past the British Islands to Norway and Scandinavia, by the Polar current setting east of Newfoundland.

The author next proceeded to consider the uses in the economy of nature of these great oceanic currents. The first that he noticed was the equalizing and ameliorating influence which they exercised on the temperature of many countries. Of this he gave several examples. Thus, our own country, though usually spoken of as a very variable climate, was subject to far less variations of range of temperature than many others in similar latitudes,—which was chiefly from the general influence of the northern branch of the Gulf-stream setting up past these islands. He had himself, on one occasion, in the month of November, known the temperature to rise no less than 52° in forty-eight hours,—having previously descended in a very few days through a still greater range; while in these countries the extensive range between mean summer and winter temperature scarcely in any instance exceeds 27°, and in many places does not amount to nearly as much. Another advantage derived from these currents was, a reciprocation of the waters of high and low latitudes,—thus tending to preserve a useful equalising of the saltness of the waters, which otherwise, by evaporation in low latitudes, would soon become too salt to perform its intended functions. Next he pointed out their use in forming sand-banks, which became highly beneficial as extensive fields for the maintenance of various species of the finny tribes, as in the

great banks of Newfoundland. Next, this commingling of the waters of several regions tended to change and renew, from time to time, the soil of these banks,—which, like manuring and working our fields, was found to be necessary for preserving these extensive pastures for the fish. Lastly, by bringing down from Polar regions the enormous masses of ice which, under the name of icebergs, were at times found to be setting down towards Tropical regions, they tend at the same time to ameliorate the great heats of those regions, and to prevent the Polar regions from becoming blocked up with accumulating mountains of ice which, but for this provision, would soon be pushed down as extensive glaciers, rendering whole tracts of our temperate zones uninhabitable wilds. Dr. Scoresby concluded by pointing out several meteorological influences of these currents, in fogs and winds.—*Literary Gazette*, No. 1914.

DEEP SEA SOUNDINGS AND CURRENTS.

Dr. Scoresby has read to the British Association, a paper "On Deep Sea Soundings and Errors therein, from Strata of Currents, with Suggestions for their Investigation." He set out by observing that the subject of Deep Sea Soundings was one which had become of great interest, inasmuch as recent soundings had tended to show that there were profundities in the sea much greater than any elevations on the surface of the earth, for a line had been veered to the extent of seven miles. He believed the first soundings beyond a mile were made by himself, when quite a youth, in the Arctic regions. Since then, in 1849, Her Majesty's ship *Pandora* had obtained soundings in the North Atlantic, at 2060 fathoms. Capt. Basnet, in 1848, in the North Atlantic got soundings at 3250 fathoms. In 1849, Lieut. Walsh, of the United States Navy, got soundings at 5700 in the North Atlantic. But a much greater depth had been obtained by Capt. Denham, in the South Atlantic.* In 1852, he got soundings at 7706 fathoms. After the line had been let out to that depth it came to a pause. It was then raised a little, and then let out again, when it came to a stop at precisely the same point. The line used was a silk one, one-tenth of an inch in diameter, weighing about one pound to every hundred yards, the plummet weighing about nine pounds, and being about eleven inches long. These were perhaps very favourable circumstances; but there were considerations connected with all deep sea experiments which rendered these results extremely doubtful, and not only doubtful, but in some cases actually erroneous. This arose from the action of what he had, in a previous paper, spoken of as the strata currents of the ocean. It would be evident that, in the case of a sounding, where, as with Captain Denham, a light lead required nine hours, twenty-four minutes, and forty-five seconds to run out, the action of these currents would affect the length of line run out, and the sounding could not be relied upon. If the sea were a stationary body, or if its currents were uniform movements of the entire mass of waters from the surface to the bottom, then the lead might be

* See Capt. Denham's Results, at page 157, ante.

fairly expected to take a direct and perpendicular course downwards. But if, in the place of sounding, strata currents, so prevalent in the sea, should be running in different directions, or what would have the same effect, if one stratum of water, say a superficial stratum, should be in motion, and the main body below at rest, no correct results could be derived.

Dr. Scoresby proceeded to show, that under such circumstances, the line would be carried away by the under current so as to make a band, which, at great depths, might go to the extent of miles. He had repeatedly noticed this effect when in the Arctic seas, in his youth, hunting the whale, and by noticing it had been able to strike many second harpoons, where the other whale fishers had been at fault. He had noticed that after a fish was struck, say at the edge of the ice, it had dived in an oblique direction under it, carrying out line for a quarter of an hour or twenty minutes, when there would be a tension of from half-a-ton to a ton on the line, and then pause for a short time. Then the fish would "take line" again, as if under the ice, and perhaps come up a-stern of the fast boat. There could be no doubt that the second pulling out was owing almost entirely to the resistance of the water. But if the boat was in clear water, and run until the pause, then her head would perhaps incline to the right or left. The boats then went ahead of her; but he, instead of doing so, had always gone to perhaps treble the angle of inclination, and had, for the most part, been rewarded by his close proximity to the fish when it rose. Well, then, all circumstances showed that the currents of the sea had very considerable influence on the line when let out, and he came, then, to the consideration of a plan for the determination of the surface and relative strata currents. No doubt broad determinations as to great and decided currents and proximate results by means of multiplied observations on currents of moderate velocities were derivable from the ordinary process; but for really satisfactory results, far more accurate and conclusive processes need to be instituted. And it would be well deserving, he thought, of an enlightened government of a maritime country especially to employ smaller war-vessels and officers in investigations on the subject, for which modes, he believed, might be made available, calculated to yield much useful and interesting information. Two leading processes appeared to him as being applicable to these determinations:—first, the planting in particular positions of inquiry in the ocean, from an attendant vessel, buoys with flags, kept in their places by a resisting apparatus below the surface, which might be denominated a current measurer, and determining, after a night's action, for instance, the changes of their position from celestial observations. Then, secondly, placing a small boat upon the water during a calm, with the current apparatus for the determination of the relative set of strata currents. The current measurer attached to, and suspended by, a small wire, run off a reel fixed in the bow of a boat, might be let down to various depths in succession, with a register thermometer attached at each new depth, when the motion of the boat and its direction, as shown by the

position of a surface float or buoy, would, after but short intervals of time, indicate proximately, the relative motion of the surface water, and the water at the several depths of the resisting apparatus below.

Dr. Buist said, that Dr. Scoresby had described the only means hitherto resorted to for ascertaining the existence and character of sub-marine currents ; and the same cause that tended to render deep-sea soundings uncertain, made the ascertainment of sub-marine currents by the old methods most unsatisfactory. Dr. Buist then exhibited and explained the new current measurer. As any attempt at a minute description without a diagram would be next to unintelligible, it may be stated generally that the instrument resembled a common weather-cock turned upside down ; and which, on being lowered by a wire to any depth, took the direction of the current. It was furnished with a compass, the needle of which was clamped at the proper time by a second wire, when a bladed wheel, like that of a patent log, or of a ventilator, was allowed to revolve for a minute, and worked like a gas-meter by an endless screw into a toothed wheel, and when the whole was drawn up, it indicated the direction and velocity of the current at any given depth. He stated that superficial currents were on a large scale ; and from on board ships best ascertained by what are termed bottle logs, or slips of paper inclosed in a bottle thrown overboard every day at noon, indicating the ship's place, or anything desired to be known regarding her. One of these was exhibited in the form of a common receipt-book, where all the formal part was printed in, and the captain had only to fill it up with writing,—counterfoils were left in the book containing a record of the information thus cast on the waters :—these amongst other things serving afterwards to indicate what proportion of the log had been picked up, what lost sight of. It was eminently expedient, and occasioned very little trouble to put a notice on this of the principal adventures the ship might have met with. Had this been always done, the history of the voyage of many vessels that had perished at sea might up to a certain point have been ascertained.

Dr. Buist also explained other instruments ; and then gave an account of a Hail Storm in India, in the Peshawur district, by which eighty-four persons, and three hundred head of cattle, were killed.

LUNAR ATMOSPHERIC TIDES.

THE facts derived a few years since from the barometrical observations at St. Helena, showing the existence of a Lunar Atmospheric Tide, have been corroborated in the last year by a similar conclusion drawn by Capt. Elliot, of the Madras Engineers, from the barometrical observations at Singapore. The influence of the moon's attraction on the atmosphere, produces, as might be expected, a somewhat greater effect on the barometer at Singapore, in lat. 1° 19′, than at St. Helena, in lat. 15° 57′. The barometer at the equator appears to stand on the average about 0006 in. (more precisely 0,0057, in lat. 1° 19′), higher at the moon's culminations than when she is six hours distant from the meridan.

EVAPORATION AND CONDENSATION.

THE total quantity of dew believed to fall in England is supposed to amount to five inches annually. The average fall of rain is about twenty-five inches. Mr. Glaisher states the amount of Evaporation at Greenwich to have amounted to five feet annually for the past five years, and supposes three feet about the mean evaporation all over the world. On this assumption the quantity of actual moisture, raised in the shape of vapour from the surface of the sea alone, amounts to no less than 60,000 cubic miles annually, or nearly 164 miles per day. According to Mr. Laidlay, the evaporation at Calcutta is about fifteen feet annually; that between the Cape of Good Hope and Calcutta averages in October and November, nearly three-quarters of an inch daily; betwixt 10° and 20° in the Bay of Bengal it was found to exceed an inch daily. Supposing this to be double the average throughout the year, we shall, instead of three, have eighteen feet of evaporation annually; or, were this state of matters to prevail all over the world, an amount of three hundred and sixty thousand cubic miles of water raised in vapour from the ocean alone.—*American Annual,* 1853.

AMOUNT OF OXYGEN IN THE WORLD.

"LET us for an instant contemplate," says Faraday,* "the enormous amount of Oxygen employed in the function alone of respiration, which may be considered in the light of a slow combustion. For the respiration of human beings, it has been calculated that no less than one thousand millions of pounds of oxygen are daily required, and double that quantity for the respiration of animals, whilst the processes of combustion and fermentation have been calculated to require one thousand millions of pounds more. But at least double the whole preceding quantity, that is to say, twice four thousand millions of pounds of oxygen, have been calculated to be necessary altogether, including the amount necessary in the accomplishment of the never-ceasing functions of decay.

As stated in pounds, we can hardly create to ourselves any definite idea of this enormous amount; the aggregate is too vast, too overpowering. It is scarcely to be grasped by our senses when reduced to tons, of which it corresponds with no less than 7,142,847 per day.

AMOUNT OF OXYGEN REQUIRED DAILY.

Whole population	1,000,000,000
Animals	2,000,000,000
Combustion and fermentation	1,000,000,000
	4,000,000,000
	2
Oxygen required daily, =	8,000,000,000 lb.

Tons.
7,142,857 in a day.
2,609,285,714 in a year.
260,928,571,400 in a century.
15,655,744,284,000 in 6000 years.
Whole quantity, 1,178,158,000,000,000

* Faraday's Lectures on the Non-Metallic Elements.

Such being the daily requisition of oxygen in the economy of nature, how great must be the total quantity existing in the world? Why, between one-half and two-thirds of the crust of this globe and its inhabitants are composed of oxygen. This will be manifested to you most conveniently by inspecting a diagram wherein the demonstration is made clear.

AMOUNT OF OXYGEN IN THE WORLD.

Principles	$\frac{1}{4}$	$\frac{3}{4}$	Oxygen is $\frac{1}{2}$ or $\frac{2}{3}$ of the globe.
Phos. lime	$\frac{3}{7}$		
Water	$\frac{8}{9}$		
Principles	$\frac{1}{8}$	$\frac{4}{5}$	
Water	$\frac{8}{9}$		
Silica	$\frac{1}{2}$	$\frac{1}{2}$	
Alumina	$\frac{1}{3}$		
Lime	$\frac{2}{5}$		
Ocean and waters	$\frac{8}{9}$		
Atmosphere	$\frac{1}{5}$		

MEAN TEMPERATURE OF THE YEAR.

Mr. Glaisher, F.R.S., has read to the Royal Society a paper wherein, after treating of the method adopted to deduce the most probable true mean temperature due to every day in the year; he observes that there are periods of some duration which are very remarkable on account of the difficulty of assigning a physical cause for the anomalies apparent in the mean temperature. Starting from the lowest temperature in January, it increases till the beginning of March, when, between the 3rd and 10th, not only is the increase checked, but there is a remarkable depression of temperature. After the 10th, the increase proceeds and is very rapid towards the end of April and the beginning of May; this rapid increase is rather suddenly checked, and followed by a period of cold towards the middle of May: this period is very marked. As remarkable a depression of temperature at this time of the year seems to have taken place in France, having been noted at Paris and at various localities, some situated near the coast; but it does not appear that the equally remarkable rise at the end of April has been noted. After the middle of May the numbers steadily increase till the 5th of July, when they attain their maximum value. The decline in the temperature towards the end of July is followed by an increase at the beginning of August, after which the decline of temperature is very regular till towards the end of November, when a sudden and considerable increase of temperature takes place; after this the curve declines to its lowest point on Jan. 8th.

SIMPLE RAIN-GAUGE.

Mr. T. W. Lawton has exhibited to the British Association a drawing of a very simple Rain-gauge, which, he said, avoided the inconveniences of evaporation, splashing, &c., uncommonly well. It consists of a tube seven or eight inches deep, whose cross section contains five square inches; this terminates in a narrow tube, graduated so as to show hundredths and thousandths of an inch in depth, received upon the area of the other.

COLOURS OF A JET OF STEAM, AND OF THE ATMOSPHERE.

Mr. Reuben Phillips, in a communication to the *Philosophical Magazine,* No 29, says:—My reasons for concluding that clouds consist of minute drops, are as follows. Prof. Henry's experiments demonstrate that the film of a soap-bubble contracts on the included air with great force considering the thinness of the film.* Now, the amount of condensation to which the enclosed air is subjected by the film is inversely as the diameter of the sphere, that is, if the thinness of the film is always the same. Supposing a little bubble to be formed in the air, like one of those imagined to form cloud, then, from the very small diameter of such a vesicle, the included air would be strongly condensed, perhaps to the extent of two or three atmospheres or more. Oxygen and nitrogen being soluble in water, and the solubility of gaseous matter in water increasing rapidly with the pressure, it follows that the particles of water will take up air at the interior surface of the film; and on these particles diffusing themselves, and so arriving at the outer surface of the film, they will liberate a quantity of air corresponding to the diminished pressure. So that from this species of exosmose alone, the bubble would soon become a homogeneous drop. I conclude, therefore, that vesicles so small as the particles which form clouds cannot long exist, if ever they are formed. With regard to the ease with which water takes up air under a high pressure, I may mention, that if water be shaken for a few minutes with air condensed to the extent of about six atmospheres, then on allowing the water to escape into the air by a quiet stream, and receiving it into a glass vessel, a considerable effervescence can be perceived.

Dr. Waller could find no evidence of vesicular structure by the aid of the microscope.†

I think the sky has an important action in producing the morning and evening red. Now, the highest clouds are evidentl ysituated below the region of the sky; and the blue colour of the sky deepens to an observer ascending a mountain. From this I conclude that the firmament consists of a distinct and very distant orb of the atmosphere, containing a great number of particles of water so small as to give a blue of the first order by reflexion. When the sun is near the horizon, its rays traverse a much greater thickness of this orb than at other times, and consequently the direct light of the sun becomes sensibly reddened by interference on transmission through the sky. The orb of the sky can, I think, hardly be regarded as being in a state of rest with respect to the earth, for it may be moved, and perhaps heaped up at times by winds; the sky may also be subject to tidal, and other motions caused by the expansions and contractions of a variable temperature, by which motions the curvature of the firmament over some spots of the earth's surface may be changed, which would cause the rays of the sun at those places to traverse a greater or less length of the firmament. I hold, that if these

* Philosophical Magazine, vol. xxvi. p. 541.

† Philosophical Magazine, vol. xxviii. p. 99, and vol. xxix. p. 103.

motions are sufficiently extensive, they must produce sensible alterations in the intensity of the morning and evening red.

With regard to the action of clouds and mists in the lower regions of the atmosphere in producing the morning and evening red, I follow Professor Forbes and M. Clausius. I look upon the clouds as white, or nearly white reflectors, which only appear coloured in consequence of red light falling on them, or from being seen through a coloured mist. I cannot, however, come to a conclusion as to whether the usual sombre colours of the clouds are generally produced in the clouds themselves or in the clearer air ; neither can I see any reason why, in accounting for the colours of the clouds, we must restrict ourselves to the consideration of those particles only which produce the first blue and red.

SCIENTIFIC BALLOON ASCENTS.

THERE has been communicated to the Royal Society, "An Account of Meteorological Observations in four Balloon Ascents made under the direction of the Kew Observatory Committee of the British Association, by John Welsh, Esq." * The ascents took place on August 17, August 26, October 21, and November 10, 1852, from Vauxhall Gardens, with Mr. C. Green's large balloon. The principal results may be briefly stated as follows :

Each of the four series of observations shows that the progress of the temperature is *not* regular at all heights, but that, at a certain height (varying on different days, the regular diminution becomes arrested, and for the space of about 2000 feet the temperature remains constant, or even increases by a small amount ; it afterwards resumes its downward course, continuing for the most part to diminish regularly throughout the remainder of the height observed. There is thus, in the curves representing the progression of temperature with height, an appearance of *dislocation*, always in the same direction, but varying in amount from 7° to 12°.

In the first two series, viz., August 17 and 26, this peculiar interruption of the progress of temperature is strikingly coincident with a *large* and *rapid fall* in the temperature of the *dew-point*. The same is exhibited in a less marked manner on November 10. On Oct. 21, a dense cloud existed at a height of about 3000 feet ; the temperature decreased uniformly from the earth up to the *lower* surface of the cloud, when a slight rise commenced, the rise continuing through the cloud and to about 600 feet above its upper surface, when the regular descending progression was resumed. At a short distance above the cloud the dew-point fell considerably, but the rate of diminution of temperature does not appear to have been affected in this instance in the same manner as in the other series ; the phenomenon so strikingly shown in the other three cases being perhaps modified by the existence of moisture in a *condensed* or vesicular form.

It would appear on the whole that about the principal plane of condensation heat is developed in the atmosphere, which has the

* See also, Year-Book of Facts, 1853, pp. 111—272.

effect of raising the temperature of the higher air above what it would have been had the rate of decrease continued uniformly from the earth upwards.

There are several instances of a second or even a third *sudden* fall in the dew-point, but any corresponding variation in the temperature is not so clearly exhibited, probably owing to the *total* amount of moisture in the air being, at low temperatures, so very small that even a considerable change in its *relative* amount would produce but a small thermal effect.

As the existence of the disturbance in the regular progression of temperature now stated rendered it necessary, in order to arrive at any approximate value of the normal rate of diminution with height, to make abstraction of the portion affected by the disturbing cause, each series was divided into two *sections,* the first comprising the space below the stratum in which the irregularity existed, and the second commencing from the point where the regular diminution of temperature was resumed. It was then found that the rate of diminution was nearly uniform within each *section,* but that it was somewhat greater in the lower than in the upper sections.

On taking a mean of both sections for each series, giving each section a value corresponding to its extent, it is found that the number of feet of height corresponding to a fall of one degree Fahrenheit is :—

On August 17	292·0 feet.
August 26	290·7 ,,
October 21	291·4 ,,
November 10 . . .	312·0 ,,

The first three values being remarkably coincident, and the last differing from them by about one-fifteenth of the whole.

The air collected in the ascents was analyzed by Dr. Miller, who states that "the specimens of air do not differ in any important amount from that at the earth at the same time, but contain a trifle less oxygen. All of them contained a trace of carbonic acid, but the quantity was too small for accurate measurement upon the small amount of air collected."—*Proceedings of the Royal Society.*

CHANGE OF REFRANGIBILITY OF LIGHT.

Professor Stokes, M.A., F.R.S., has communicated to the Royal Society a paper, the principal object of which is to explain a mode of observation by means of which the author found that he could exhibit, with ordinary day-light, the change of refrangibility produced by substances opaque as well as transparent, even when they possessed only a low degree of sensibility. The method requires hardly any apparatus; it is extremely easy in execution; and it has the great advantage of rendering the observer independent of sun-light. On these accounts the author conceives that it might be immediately applied by chemists to the discrimination between different substances. The method is as follows :—

A large hole, which ought to be several inches in diameter, cut in the window-shutter of a darkened room, serves to introduce the light,

and a small shelf, blackened on the top, attached to the shutter immediately underneath the hole, serves to support the objects to be examined, as well as one or two absorbing media. The hole is covered by an absorbing medium, called by the author the *principal absorbent*, which is so selected as to let through, as far as may be, the feebly illuminating rays of high refrangibility, as well as the invisible rays still more refrangible, but to stop the rays belonging to the greater part of the visible spectrum. A second medium, called by the author the *complementary absorbent*, is chosen so as to be as far as possible transparent with regard to those rays which the first medium stops, and opaque with regard to those which it lets through. The object to be examined is placed on the shelf, and viewed through the second medium. If the media be well-selected, they together produce a very fair approach towards perfect darkness; and if the object appears unduly luminous, that arises in all probability from "fluorescence." To determine whether the illumination be really due to that cause, it is commonly sufficient to remove the complementary absorbent from before the eyes to the front of the hole, when the illumination, if it be really due to fluorescence, almost wholly disappears; whereas, if it be due merely to scattered light which is able to get through both media, it necessarily remains the same as before. In the case of objects which are only feebly fluorescent, it is sometimes better to leave the second medium in its place, and use a third medium, called by the author the *transfer medium*, which is placed alternately in the path of the rays incident on the object-end of the rays coming from it to the eyes.

Independently of illumination, the change of colour corresponding to the change of refrangibility, and the difference of colour with which the object appears, according as the transfer medium, or the complementary absorbent used as a transfer medium, is held in front of the eyes or in front of the hole, afford in most cases a ready mode of detecting fluorescence.

Instead of trusting to the *absolute* appearance of the object, it is commonly better to compare it with some fixed standard. The standard substance ought to be such as to scatter freely visible rays of all refrangibilities, but not to give out rays of one refrangibility when influenced by rays of another. The author employed a white porcelain tablet as such a standard; and the object to be observed was placed on the tablet, instead of being laid directly on the blackened shelf.

Another mode of observation consists in using a prism in combination with the principal absorbent. The object being placed on the tablet, a slit is held close to it, in such a position as to be seen, projected partly on the object and partly on the tablet, and the slit is then viewed through a prism. The fluorescence of the object is evidenced by light appearing in regions of the spectrum, in which, in the case of the rays coming through the principal absorbent, and, therefore, in the case of the rays scattered by the tablet, there is nothing but darkness.

The author states that these methods proved to be of such delicacy,

that, even on an unusually gloomy day, he was able readily to detect the fluorescence of white paper; and even in the case of substances standing much lower in the scale, the fluorescence could be detected in a similar manner.

In conclusion, the author states that he had found the property of fluorescence to belong to a peculiar class of salts, the platinocyanides, making a third instance in which this property had been connected with substances chemically isolated in a perfectly satisfactory way. The present instance opens a new field of inquiry in relation to the polarization of the fluorescent light.—*Proceedings of the Royal Soc.*

PROPERTIES OF LIGHT.

LORD BROUGHAM, F.R.S., has communicated to the Royal Society "Further Experiments and Observations on the Properties of Light," wherein the author considers that Sir Isaac Newton's experiments to prove that the fringes formed by inflexion and bordering the shadows of all bodies, are of different breadths when formed by the homogeneous rays of different kinds, are the foundation of his theory, and would be perfectly conclusive if the different rays were equally bent out of their course by inflexion; for in that case the line joining the centres of the fringes on opposite sides of the shadow being, as he found them, of different lengths, the fringes must be of different breadths. He found that line to be $\frac{1}{37\frac{1}{2}}$ inch in the red, $\frac{1}{46}$ in the violet of the nearest fringe; $\frac{1}{22}$ in the red, $\frac{1}{27}$ in the violet of the second fringe. But if the rays are of different flexibility, if the red, for example, is bent to a greater distance from its course than the violet, the experiment becomes wholly inconclusive; and the line joining the centres may be greater in the red than in the violet, although the breadths of the two fringes are equal, or even the violet fringe may be broader than the red. A variety of experiments are adduced in the paper to show that this property of different flexibility exists, which Sir I. Newton had not remarked. *See* the Experiments in the Proceedings of the Royal Society.

OSCILLATORY THEORY OF LIGHT.

MR. MACQUORNE RANKINE, has communicated to the British Association a "General View of an Oscillatory Theory of Light." "In conclusion," says Mr. Rankine—"it may be affirmed that, as a mathematical system, the proposed theory of oscillations round axes represents the laws of all the phænomena which have hitherto been reduced to theoretical principles, as well, at least, as the existing theory of vibrations; while as a physical hypothesis, it is free from the principal objections to which the hypothesis of vibrations is liable."

MIXTURE OF HOMOGENEOUS COLOURS.

PROFESSOR HELMHOLTZ, in a communication to the British Association, remarks that he has endeavoured to prove in a previous paper, that mixture of pigments is not identical with the mixture of coloured light, and that these two proceedings give sometimes very

different results as for the shade of the mixed colour. He had since made experiments not only with compound coloured light reflected from the surface of coloured bodies, but also with homogeneous prismatic colours. For the latter purpose he brought together two prismatic spectra of different direction in the same place, so that every coloured band of the one crossed under a right angle every band of the other. In this manner there were displayed at once all possible combinations of two homogeneous colours; and besides, the apparatus was so disposed that he could alter continuously by the proportion of mixture. By these experiments he obtained a curious result. He could find only a single field of mixed colours which, by bringing the intensity of the two spectra to a proper proportion, could be made white. It was that point where yellow and indigo are combined. He did not succeed, however, to produce white by combination of any other pair of homogeneous rays.

NEW PHOTOMETER.

Dr. Price proposes to arrange two inclined mirrors in a box, contrived to reflect the standard light and the light to be measured, so as to cross each other at a piece of ground glass or oiled paper on the top of the box; then it will be easy, he asserts, to adjust the distance of the standard light so as to make the two reflected lights appear equally intense,—and then, on the common principle, the illuminating power of the light to be estimated can be calculated.

OPTICAL PHENOMENA, AND CRYSTALLIZATION.

Sir David Brewster has read to the British Association, a paper "On the Optical Phenomena and Crystallization of Tourmaline, Titanium, and Quartz within Mica, Amethyst and Topaz." The author, after stating that crystals of titanium within quartz had been long known and attended to, drew attention to the fact that regular crystals of tourmaline, titanium and quartz had been discovered by him within mica, amethyst and topaz. That in some instances these crystals had been found grouped in very regular figures, and that the groups of crystals were sometimes distributed over what were obviously surfaces of inner crystalline forms of exactly the same shape as the entire crystal, from which the author drew inferences as to the original growing of the crystal. He also entered into an examination of some of the optical peculiarities of these crystals.—*Athenæum,* No 1152.

CRYSTALLINE STRUCTURE.

Sir David Brewster has communicated to the British Association, a paper "On the Production of Crystalline Structure in Crystallized Powders by Compression and Traction." The author first stated that he had found by pressing certain crystalline powders against slips of glass, sometimes smooth, sometimes roughened by grinding, with the clean broad blade of a knife or spatula, and drawing it along, he could give to the mass of powder thus treated the same polarizing action on light possessed by large

crystals of the same kind; and which could be given to annealed glass and other non-crystalline substances by mechanical compression; but which they lost when relieved from the compressing force. The author then gave an enumeration of the crystalline powders in which he had succeeded by this compression and traction in producing this polarizing structure,—distinguishing those in which the glass over which they were so distributed required to be rough, from those in which it might be used smooth. He also enumerated the powders which he had tried, but with which he had not succeeded in producing the same effect.—*Athenæum*, No 1152.

IRISES FROM SNOWDON.

THERE has been communicated to the British Association, a "Notice of several complete Concentric Irises seen from a Peak of Snowdon," by Mr. W. Grey; who, in ascending Snowdon, one evening in last June, and having got above the clouds, was suddenly surprised to see depicted on them, on the opposite side from the sun, three beautifully complete coloured rings, the centre of which appeared to him a very dark violet. There was also a fourth but incomplete ring seen, the lower part of which appeared cut off by the shadow of the peak on which he stood. The order of the colours, which were very vivid, was the same in all the rings—the red being innermost. The morning was cold, but the air, even at that elevation, was not frosty. Mr. Grey, as soon as he descended the mountain, prepared a drawing of the irises, which he exhibited.

SPECULA OF REFLECTING TELESCOPES.

MR. SOLLITT, of Hull, has read to the British Association, a paper "On the Composition and Figuring of the Specula for Reflecting Telescopes." The novelty of the author's plan consists in introducing a little nickel in the tin, as helping to produce a reflector of more polish. Lord Rosse's proportions of metal are, copper 32, tin 14·9. Mr. Sollitt used, as being preferable, copper 32, tin 15·5, nickel 2. He also found a little arsenic useful in preventing oxidation. After slightly noticing the casting and grinding, the author referred with some detail to the composition and figuring of the polisher. The composition, as used by him, was pitch and resin, with a small admixture of flour. The surface he grooved with concentric equidistant circular grooves—not in parallel and cross grooves. These concentric grooves he crossed by radial grooves, widening as they receded from the centre, so as to be bounded by curved outlines. By giving proper form and dimensions to these curves, the parabolic form could be most accurately given to the speculum in the process of polishing. The form of the curved outlines of these radial grooves he found should be parabolic.

THE STEREOSCOPE, AND ITS APPLICATION TO PHOTOGRAPHY.

M. CLAUDET has communicated to the Society of Arts, a paper on this application, which he commenced by stating that the beautiful discovery of Professor Wheatstone of the Stereoscope, which eluci-

dates the phenomenon of Binocular Vision, although known in the scientific world for nearly fifteen years,* has only lately attracted public curiosity, from its now general application to photographic productions. Although Professor Wheatstone, soon after the discovery of photography, made use of the Daguerréotype and Talbotype pictures as the most efficient means of producing the illusion of solid representation in his stereoscope, no practical photographers availed themselves of the discovery, and it remained concealed in scientific records until the subject was brought into notice at the British Association, in Birmingham, in 1849, by Sir David Brewster. Professor Wheatstone's first stereoscope was composed of two small mirrors placed at an angle of ninety degrees, and each reflecting to one eye one of the two binocular images. He afterwards constructed a refracting telescope, composed of two prisms of about eight degrees each, placed between the eye and one picture, and refracting the two images on one intermediate space, where they coalesced. Sir David Brewster recommended a stereoscope somewhat similar, but, instead of two common prisms, supplied with two semi-lenses, acting at the same time as refracting prisms and as magnifying glasses, by which the pictures could be considerably enlarged.

This instrument was so constructed that all direct reflection was avoided, which is an indispensable arrangement for the inspection of Daguerréotype surfaces; and this contrivance, and the convenient shape of the instrument, had been partly the cause of its great popularity and usefulness. This instrument was called by Sir David Brewster the Lenticular Stereoscope. Photography alone can produce two images perfectly identical to the two images on the two retinæ; and if we can place them so that the right perspective is seen only by the right eye, and the left perspective only by the left eye, both in the line of direct vision, we have on each retina the same representation we had from looking at the natural objects. This is precisely the effect of the stereoscope; therefore, in the stereoscope we have the same sensation of solidity and distance as we have with two eyes. When we look at a solid object, such as a cube or a statue, it is obvious that the right eye sees some parts of the solid which the left eye cannot see, and *vice versâ*. In looking with two eyes, the objects appear solid and separated from each other, because we are unconsciously taught to judge that what is seen by one eye, and not by the other, must be on a receding part of the solid, and hence the idea of solidity in our mind. When we direct our vision from an object upon an object nearer or more distant, we are obliged to shift the two retinæ in order to cause their axes to correspond with the new angle of vision, and to obtain a single vision. This is done with wonderful rapidity, and we are unconscious of the exertion.

The above phenomenon was illustrated by two photographic pictures on glass, intended for the stereoscope. M. Claudet showed that these two binocular images were not exactly similar—that each had a different perspective projection. He placed one against the other,

* See a notice of the Stereoscope, in the first Year-Book of Facts, 1839, p. 88.

and being able to slide them in a grooved frame, there was only one plane of the perspective in each picture which by the superposition could produce a single image, the objects on planes more distant or nearer were distinctly seen double; when the objects on the foreground plane were coinciding, all the objects behind were more and more separated, according to the distance; when the objects of the middle plane were coinciding, all the other objects before or behind were separated; and when the more distant objects were coinciding, all the others before were more and more separated as they were nearer and nearer. Therefore, in observing the two binocular pictures in the stereoscope, the eyes are obliged to alter their convergence in a certain degree for each distance, and it is to that exertion, and to the duplicity of the images, and their degree of separation both ways, that the mind has the sensation of relief and distance of all the objects represented in the stereoscopic pictures, and the process is exactly the same when looking in the stereoscope on the two binocular pictures, or when looking naturally at the real objects. If the two perspective projections of the Daguerréotype images are taken at a greater angle than they are with the eyes for the same apparent size, the optical axes have to alter their convergence in a greater ratio in passing from one point to another, the double images within and beyond the point of vision are more separated than in the natural vision—and from these two exaggerated effects we conclude or feel that the objects are more separated than they are in nature, and that the distance or relief is greater. By magnifying more or less the stereoscopic pictures, we, by the same reason, increase less or more the stereoscopic effect. This is exemplified by looking with a double opera glass. If we look through the large lens near the eye, we considerably decrease the size of objects; and as the angle of vision remains the same as for natural vision, the eyes have to alter more their convergence, in surveying the various planes, than they would have to do if the objects were really at the distance at which they appear to be. In looking through the eye-pieces of the same opera-glass, we have the contrary effect, and a very unpleasant one, as we magnify the pictures. If they were seen by the eyes at the distance they appear to be, the angle of the optical axes would be larger than the natural angle; and the exertion in converging from one point to another of the magnified picture is less through the opera-glass than it should be if we were looking at the distance giving the same size of image on the retina. For this reason double opera-glasses are defective, and produce an incongruous sensation, which is very disagreeable. A single opera-glass is far preferable, and gives an idea of greater distance between the objects, and more relief of their various parts, than a double glass.

M. Claudet next referred to the phenomenon of the singular similarity of effect between squinting outwards and the stereoscope, and squinting inwards and the pseudoscope, when looking at two binocular pictures; for by squinting either way, we can bring the right and left pictures on corresponding parts of the two retinæ. In squinting outwards on a stereoscopic slide, we have, without the stereoscope,

the effect of relief and distance; and by squinting inwards, the same effect of intaglio and inverted distances we have with the pseudoscope, and by squinting *vice versâ* we have a contrary effect. It is easier to squint inwards, as we do when looking near our nose; and to obtain, by so squinting, the stereoscopic effect in examining the two pictures, we must place the right image under the left eye, and the left image under the right eye. In so doing we have the most beautiful effect of relief and distance, and more perfect than with the instrument, because the prisms and lenses always cause a certain amount of distortion from spherical and chromatic aberration. We have also another advantage, which is, that on placing the pictures nearer or farther off, we decrease or increase at will the stereoscopic effect, or the relief and distances of the various parts of the picture. M. Claudet illustrated his lecture by a number of excellent diagrams, by which all the various phenomena were fully explained. He showed that two exactly similar pictures placed in the stereoscope, produced less relief than one of these pictures seen alone with one eye. From this fact he proves why painting can never represent the distance and relief of nature, or stereoscopic vision; that the vision with two eyes of a monocular picture gives a sensation of less relief and distance than with one eye.—*Literary Gazette*, No. 1883.

M. Claudet has also read to the British Association a paper "On the Angle to be given to Binocular Photographic Pictures for the Stereoscope." M. Claudet described most minutely the several circumstances which rendered the taking of binocular photographic pictures a very difficult task; pointing out the circumstance that, when the two cameras were so adjusted as to take one part of the picture correctly, the adjustments for other parts were improper. He pointed ont the exaggerated effect produced on the appearance of length given by this circumstance to some members of the body, and greater depth or distance to others. He showed that the remedy used by painters for these difficulties of their art were not available to the photographer; and he explained the principles on which distance to him was of the utmost importance,—and how at the various distances which he could only command, he must adapt the distance of the cameras and the angle at which their visual lines were adjusted so as to produce the best possible picture. M. Claudet exemplified his several assertions as he proceeded, by exhibiting several very beautiful portraits and groups, adapted to the binocular stereoscope,—the effect of which was most pleasing and the illusion complete.

THE STEREOSCOPE AT THE PANOPTICON.

In the Photographic Department of the Panopticon, in Leicester-square, may be seen a new arrangement of the Stereoscope, which has been brought out here, and which constitutes a decided improvement upon the common form of that instrument. It consists, first, in mounting it upon a heavy brass stand, which, having a telescopic stem, admits of the instrument being raised to any convenient height above the table, and in that position it may be retained by

a few turns of a screw which tightens a small strap at the top of the lower portion of the instrument. The connexion between the box of the stereoscope and the stand is effected by a strong hinge, having just sufficient friction to enable the operator easily to incline the instrument at any angle he pleases, and to make it rest steadily in that position without the aid of any other adjustment. Having brought it into the best position to admit the light, there is a platform of the size of the bottom of the instrument, which is hinged to the lower edge of the box next the operator, which must now be moved into its proper position. For this purpose, a silk cord is attached to one side of the platform near its remote edge, and this is passed over a small pulley on the box, and supports a counterpoise. The operator places a white card, or one of tinted paper, upon the platform, when in the best position for turning the light upwards through the instrument, which is readily obtained, and then he introduces the transparent slide containing the binocular perspectives. The effect of this combination is singularly good. A warmth and tone are imparted to the several surfaces comprised in the picture, which immeasurably heighten the power of the stereoscope. Several subjects were handed to us, which we submitted to the operation of this form of the instrument, and in every instance the result obtained was most effective. A view of Paris, embracing in the field of view a large extent of that city, struck us in particular as being remarkably perfect in the realization of nature, and conveyed an infinitely better idea of the subject than the first representation of it, merely pictorial, could by any possibility afford. Among other portions of it, was a large quadrangular court, included between lofty houses. The perspective embracing the upper portion of the court, the idea of depth was suggested with irresistible force, and the distribution of the masses of light and shade, with all their gradations, appeared more impressive than is the case where the operator is not so much at liberty to procure for his experiment the most favourable conditions.

The Panopticon Stereoscope also comprises a sliding motion for both the sights, thereby rendering it available for every range of vision; and by the addition of a slight spring catch, the slide is retained in its place, and protected from accident.

A very useful and clever application of the instrument has recently been made. It appears that large houses manufacturing solid objects of design in the fine arts, have hitherto furnished their travellers with specimens of their recent productions, which are carried from place to place by their travellers, and are commonly given away to large customers. Instead of doing so in future, the object will be sent to the photographer, who will prepare by the camera the two perspectives for the best view of it, and a number of copies will be returned with the object to the manufacturer at a small cost. The traveller will take these with him, and a stereoscope, and with his samples thus reduced into small space, he will, on any occasion, be able to convey to the customer an adequate idea of the object represented. In a little time, probably, the stereoscope may be dispensed

with by the traveller; for if the customers provide themselves with them, it will be only necessary to send the perspective by post, and they can realize the object for themselves.

It is difficult, at present, to foresee the number of useful applications of which the stereoscope is susceptible. Though now only in the very infancy of its use, it has answered a variety of useful purposes, and none more useful than the powerful incentive which it has given to the cultivation of the beautiful art of photography. The facilities afforded at this Institution for the combined study of photography, and of the aid which the stereoscope can furnish in the superposition of photographic projections, become doubly important from this consideration, and reflect great credit on the judgment and enterprise of the manager.

The large Electrifying Machine, the plate of which is 10 feet in diameter, and has been cast by the Thames Plate Glass Company, will soon be ready. It will be carried on a large and beautiful iron frame-work, and driven by steam power; so that a brilliant series of experiments in electricity and its associated sciences may be anticipated. Mr. Whitworth has sent in £6000 worth of lathe and other machinery, which will be turned to account for the best purposes of practical instruction in the art of the engineer.—*Mechanics' Magazine*, No. 1560.

PORTABLE CAMERA.

MR. GEORGE STOKES has invented a Camera which weighs only nine pounds with the shutter, and will take a picture eleven inches square. The shutter is so arranged that it will contain from twelve to twenty pieces of prepared paper, each piece between separate sheets of blotting paper. Light and air are completely excluded by the paper being pressed by the front portion of the shutter. When required for use, the first piece of paper is placed at the back of the glass, by the assistance of a very small hood. The impression is then taken, and by removing the millboard, the paper will fall back into its place. At the same time another piece can be brought forward ready for another picture before focussing; and so on, to the end. The hood is made of India-rubber cloth, and answers the purpose of a focussing-cloth, without the necessity of removal during the day. This simple arrangement has been found to be of great service, and to produce a saving both in time and trouble.

Another Portable Camera, the invention of Mr. George Edwards, is thus described in the *Journal of the Society of Arts*:—The framework is entirely of metal, the covering or sides being of "cording," or any other sufficiently opaque and flexible material. The colour of this covering would be better white than black, especially for the use of collodion.

The top of the stand is furnished with a ball-and-socket-joint, with a screw on the top. To this is screwed by its centre a light brass tube, equalling the total length of the apparatus, and forming its foundation. At right angles to one end of this is secured (when required) a frame of sheet brass, of a size and form to receive the

"plate-box" to slide into it. On the other end is a slide which may be cramped in any position; to this is attached the lens end of the camera,—this, however, is only large enough to receive the lens; four wires connect the four corners of the large end with the four corners of the small end, their ends being secured to the former by spring catches; their other ends pass freely through holes provided for that purpose in the small end, a distance sufficient for any adjustment of focus.

The skeleton or outline thus formed (that of a truncated pyramid) is covered with the material above described. The focus being adjusted, the two upper wires are securely clamped by screws provided for that purpose, so that no shade whatever can exist between the picture and lens,—an essential requisite for good definition.

The advance of the lens is a diaphragm of metal, supported by a folding bracket, the shading tube of which is also of silk "cording," and which, when packed up, folds over the lens.

To reduce the camera to its smallest dimensions, the wires are taken out and packed inside the tube; the small end of the camera then folds with the covering into the larger end, when the following figures give correctly the results:

The *area of the picture* obtained is 76 *per cent.* of the *area of the largest end* of the camera.

The total *bulk* (with the looking-glass and tube) is only 4 *cubic inches per square inch of the picture.*

The total *weight* (without the looking-glass) is only $1\frac{1}{2}$ *oz. per square inch of the picture.*

These results are, however, obtained in what may be called a *small* camera, with an area of picture of only $38\frac{1}{2}$ square inches; in larger cameras, for which this arrangement is pre-eminently adapted, these results would evidently be still more advantageous. Neither is there any nicety of workmanship required which renders the construction expensive or repair difficult; a very simple modification would permit the lens to be placed eccentrically with the picture.

Two short legs screwed into the lower part of the brass frame (when required) would enable this camera to stand upon an ordinary tube, if necessary; and a short right-angled junction will permit the camera to be placed with the longest diameter vertical for tall objects.

A looking-glass for reflecting the view, and placing it *erect,* admits a reduction in the length of the legs, whilst a very small curtain keeps off all interfering light.

The present plate-box is adapted for glass or silvered plate; it is scarcely necessary to say that a simpler modification would adapt the same space for the reception of one or more papers.

THEORY OF THE PILE AND THE AURORA BOREALIS.

M. DE LA RIVE, the celebrated physicist of Geneva, has presented to the Paris Academy of Sciences the first volume of a treatise on Theoretical and applied Electricity, which he has published in London,

and of which he is now preparing an edition in French. In explaining the plan of his work, M. de la Rive dwelt more especially on the Theory of the Pile. He has always been a defender of the chemical theory; but while acknowledging the influence of chemical action, he now recognises that we cannot always admit that chemical action precedes the production of electricity, and he is led to consider the two phenomena as commonly simultaneous, and due to a more general cause—viz., molecular polarization, which is established at the moment of contact of two bodies susceptible of acting chemically on one another. M. de la Rive also expresses his opinion on the cause of the Aurora, which he explains, not by a radiation of the polar magnetism, but by a purely electrical action. After examining nearly all recent observations, he believes that he may attribute this phenomenon to the electricity with which the currents of air are charged that rise from the equatorial regions, and travel in the upper atmosphere towards the poles, where they combine with the negative electricity of the earth, forming, under the influence of the magnetic pole, true luminous arches.—*American Journal of Science and Arts*, No. 47.

PASSIVE STATE OF METEORIC IRON.

WOHLER has observed the curious fact that the greater portion of Meteoric Iron he has examined is in the so-called Passive State; that is to say, it does not reduce the copper from a solution of the neutral sulphate of copper, but remains bright and uncoppered therein. But if touched in the solution with a piece of common iron, the reduction of the copper commences immediately upon the meteoric iron. It also becomes active instantaneously on the addition of a drop of acid to the solution of copper; but if the reduced copper be filed away, the new surface is again passive. It was ascertained by experiments on meteoric iron which had never been in contact with nitric acid, and nevertheless was passive, that this state could not have been produced by the corrosion of the surface by the acid, for the production of the Widmannstattean figures. It was thought first that this deportment might be employed as a means of distinguishing true meteoric iron; but it soon appeared that some undoubtedly genuine meteoric iron was not in this state. Seven specimens, from different parts of the world, examined, were found to be passive; six reducing, or active, and four which do not become coated with copper immediately, but on which the reduction gradually commences after a longer or shorter contact with the cupreous solution, and usually from one point, or from the margins of the fluid.

These peculiarities appear to have no connexion, either with the presence of nickel, or the property of forming regular figures on corrosion. It was also found that an artificially-prepared alloy of iron and nickel, which on corrosion acquired a damasked surface, reduced the copper from solution in the same manner as common iron. Whether this state is proper to all meteoric iron on its reaching the earth, and, as may have happened in the case of the active kinds, has only been lost in the course of perhaps a very long period of time, and

what probable opinion can be formed of these phenomena, must be settled by experiments and observations of a more extended nature. —*Poggendorf's Annalen.*

CRYSTALLIZATION OF GLASS.

SOME interesting experiments on this subject have been made by M. Leydolt in the course of his investigations upon the crystallization of the silicates. He had examined agate by subjecting it to the dissolving action of fluohydric acid, and obtained a surface with projecting crystals of quartz, that were left untouched by the acid. On subjecting Glass in the same manner, he was surprised to see that it was far from homogeneous in its texture. All the kinds of glass examined contain more or less perfectly distinct crystals, regular and transparent, encased in an amorphous base. The crystals were brought out by exposing it to the vapours of fluohydric acid, and vapour of water, and arresting it when the crystals appear; the amorphous part is a little the most soluble in the acid. M. Leydolt observes also, that some natural crystals, pure and transparent, and apparently homogeneous, present similar deficiency in homogeneity with the glass, and he has the subject under further examination.—*American Annual of Scientific Discovery,* 1853.

THE EUSTACHIAN TUBE.

A PAPER has been read to the Royal Society "On the Muscles which open the Eustachian Tube," by J. Toynbee, Esq. The author commenced by alluding to the opinion generally entertained by anatomists—viz., that the guttural orifice of the Eustachian Tube is always open, and that the air in the tympanum is constantly continuous with that in the cavity of the fauces. An examination of the guttural orifice of the Eustachian Tube in man and other animals has led the author to conclude, that except during muscular action this orifice is always closed, and that the tympanum forms a cavity distinct and isolated from the outer air. The muscles which open the Eustachian tube in man are the tensor and levator palati, and it is by their action during the process of deglutition that the tubes are ordinarily opened. That the act of swallowing is the means whereby the tubes are opened, is shown by experiments, of which the author cited some. The author gives an account of the Eustachian tube and its muscles in mammalia, birds, and reptiles. The conclusion at which he arrives respecting the influence of the closed Eustachian tube, is, that the function of hearing is best carried on while the tympanum is a closed cavity, and that the analogy usually cited as existing between the ordinary musical instrument, the drum, and the tympanum, to the effect that in each it is requisite for the air within to communicate with the outer air, is incorrect. On the contrary, the author shows that no displacement of the air is requisite for the propagation of sonorous undulations; and that were the Eustachian tube constantly open, these undulations would extend into the cavity of the fauces, there to be absorbed by the thick and soft mucous membrane, instead of being confined to the tympanic cavity (the

walls of which are so peculiarly well adapted to reproduction), in order that they shall be concentrated upon the labyrinth. In corroboration of the above views, the author states, that in cases of deafness dependent simply upon an aperture in the membrana tympani, whereby the sonorous undulations are permitted to escape into the external meatus, the power of hearing has been greatly improved by the use of an artificial membrana tympani made of very thin vulcanized India-rubber or gutta percha, which is so applied as again to render the tympanum a closed cavity.

THE SPINAL CHORD.

A PAPER has been read to the Royal Society, "On certain Functions of the Spinal Chord," by Mr. J. L. Clark. These investigations were undertaken by the author with the view of settling the long-agitated question whether all the roots of the spinal nerves terminate in the spinal chord, or whether any part of them ascend within the white or grey columns of the brain. The author infers from his experiments that nearly all, if not the whole, of the fibres composing the roots of the spinal nerves proceed at once to the grey substance of the chord, and that if any of them ascend directly to the brain, it must be those only of the posterior roots, which run longitudinally in the posterior white columns.

PRETENDED OCCURRENCE OF IODINE IN MILK, EGGS, AND THE ATMOSPHERIC AIR.

SOME years since, Chatin instituted investigations into the Distribution of Iodine; when he not only found it in all spring-waters, in fresh-water and land plants, in the most various articles of food, in artificial beverages such as wine and beer, but, according to him, it constantly occurs also as an essential constituent in the inhabitants of our rivers and in land animals.

As it was shown, about the same time, by Meyrac, Marchand, and others, that the distribution of iodine is much more considerable than had hitherto been supposed, it could excite no surprise that it should be found in the animal organism; here, as everywhere in nature, it was to be regarded as the constant companion of the chlorine compounds.

Chatin, however, regards iodine not as an accidental, but as an essential constituent of the organs; and according to his statements with respect to the quantities of it contained in eggs, milk, &c., he appeared to be perfectly right in so doing. According to Chatin, a hen's egg contains more iodine than 1 litre of milk, whilst this again contains more than our usual articles of food and beverage. He also considers iodine to be of importance in the respiratory process. Normally the air contains 1·500 milligrm. of iodine in 4000 litres, and during respiration 4·5 are said to disappear. Fourcault, who has occupied himself with the study of the causes of goitre and cretinism, examined the air in those places where these diseases are indigenous; in these localities he found the atmosphere free from iodine, and concluded accordingly that the deficiency of iodine was the

principal cause of goitre and cretinism. Chatin immediately proved that the air of the Alps was much poorer in iodine than the atmosphere of Paris; he found less iodine in the valley of the Rhone than in that of the Seine, less still in the valley of the Isère, and a constant diminution towards the Alps. He only met with it again in the plain of Piedmont, after it had eluded his investigations on the French side of the Alps.

As, therefore, the influence of iodine appears to be of the greatest importance to the development and continuance of the animal organism, the author regarded the testing of Chatin's statements as of sufficient importance to undertake it himself with great care.

Goitre does not occur in Göttingen, whilst in some of the neighbouring villages, in Lengden, for instance, it is very frequently met with. If the want of iodine in the air were the cause of the evil, it might be expected that a difference would be presented between the quantity of iodine contained in the air of Göttingen and that of Lengden. The author therefore examined first the air of Göttingen; he allowed 4000 litres of air to pass in small bubbles through a stratum of solution of caustic soda 18 inches in thickness, adding quicklime to the solution from time to time to remove the carbonic acid which was taken up by it. The apparatus was so arranged that the passage of 4000 litres of air required nearly a whole week, so that no iodine could be lost. Nevertheless, on testing for iodine, a negative result was obtained, so that an investigation of the air of Lengden must appear perfectly unnecessary.*

The author has sought for iodine in cow's milk and hen's eggs with a similar result. Thus no trace of iodine was to be found in 12 eggs or in 600 or 6700 grms. of milk. The fluids in which the iodine must be concentrated amounted in all cases only to a few centimetres; for testing them, cold starch-paste and pure nitric acid into which nitrous acid had previously been passed were employed.

The author does not deny that, by the employment of still larger quantities of milk and eggs, the exhibition of iodine may perhaps be possible, and that under certain circumstances iodine may also occur in the atmosphere, especially in the neighbourhood of manufactories and chemical laboratories; but from his experiments he considers that he may draw the conclusion, that Chatin's statements are to be considered as erroneous throughout, and that the absence of iodine in the air cannot be the cause of goitre and cretinism.—*Nachrichten von der Gesellsch. der Wiss. zu Göttingen.—Philosophical Magazine*, No. 38.

IDENTITY OF PLANTS AND ANIMALS.

MR. T. H. HORSLEY, F.R.E., has read to the Royal Institution, a paper "On the Identity of Structure of Plants and Animals," which he concluded as follows:—In both plants and animals, there is

* The same result was obtained by Mr. S. Macadam, of Edinburgh (see "Chemical Gazette" for August 2, 1852), with whose researches the author does not appear to be acquainted.—ED. *Philosophical Magazine.*

one histological element, the endoplast, which does nothing but vegetatively repeat itself: the other element, the periplastic substance, is the subject of all the chemical and morphological metamorphoses in consequence of which specific tissues arise. The differences between them are mainly—1, that in the plant the endoplast grows, and, as the primordial utricle, attains a large comparative size; while in the animal the endoplast remains small, the principal bulk being formed by the periplastic substance; and, 2, in the nature of the chemical changes in the periplastic substance in each case. This does not, however, always hold good, the Ascidians furnishing examples of animals whose periplastic substance contains cellulose. In conclusion, the lecturer endeavoured to point out that the value of the cell-theory was purely anatomical; and that the attempts which had been made to base upon it some physiological explanation of the facts of life,—by the assumption of cell-force, metabolic force, &c. &c.,—were no more philosophical than the old notions of actions of the vessels, &c., of which physiologists have lately taken so much pains to get rid.—See the entire paper, in the *Literary Gazette*, p. 435.

THE TRANSITION FROM ANIMALS TO PLANTS.

It has been long asserted by Bory de St. Vincent and others, that there exist in nature organized bodies which are animal at one period of their lives, and vegetable at another! This, if true, would for ever put an end to the possibility of distinguishing the two kingdoms when they shall each have arrived at their lowest forms. Its truth has, however, been denied. On the contrary, Kützing, in his recent magnificent work on Algæ, insists that it happens in his *Ulothrix zonata*. He asserts that in the cells of that plant there are found minute animalcules, with a red eye point, and a transparent mouth place; that they are not in fact distinguishable from Ehrenberg's *Microglena monadina;* these bodies, however, are animals only for a time. At least they grow into vegetable threads, the lowest joint of which still exhibits the red eye point. This phenomenon, which Kützing assures us he has ascertained beyond all possibility of doubt, puts an end to the question of whether animals and plants can be distinguished at the limits of their two kingdoms, and sufficiently accounts for the conflicting opinions that naturalists entertain as to the nature of many of the simpler forms of organization.

Such being the case, it is not worth attempting to decide whether the lowest forms of structure belong to the one kingdom or the other; it will be sufficient that they have been regarded as plants by many eminent naturalists.

It is in this microscopical, cellular state of existence that the Animal kingdom ends and the Vegetable commences. It is from this point that the naturalist who would learn how to classify the kingdom of plants must take his departure. He perceives that those species which consist of cells either independent of each other (*Protococcus uredo*), or united into simple threads (*Conferva monilia*), are succeeded by others in which the threads collect into nets (*Hydrodictyon*),

or plates (*Ulva*), or the cells into masses (*Laminaria agaricus*); peculiar organs make their appearance, and, at last, as the complication of structure increases, a leaf and stem unfold as distinctly limited organic parts. Kützing cut to pieces the marine animal called *Medusa aurita*, washed the pieces carefully in distilled water, put them into a bottle of distilled water, corked it close, and placed it in a window facing the east. The bits of Medusa soon decomposed, and emitted a very offensive odour, during which time no trace of infusoria was discoverable. After a few days, the putrid smell disappeared, and myriads of Monads came forth. Shortly after, the surface of the liquid swarmed with extremely small green points, which eventually covered the whole surface; similar points attached themselves to the sides of the bottle. Seen under a microscope, they appeared to be formed of numberless monads, united by a slimy mass, and, at last, after some weeks, the *Conferva fugacissima* of Lyngbye developed itself in perfection.

Late observations on the reproductive bodies of some Algæ show that their motion is produced by vibratile cilia, exactly in the same way as in certain animals. But it is exceedingly difficult to imagine the transformation of one real species into another. The same species may assume a variety of forms, according to varying circumstances, and it is highly instructive to observe these changes; but that the same spore should, under different circumstances, be capable of producing beings of an almost entirely different nature, each capable of reproducing its species, is a matter which ought not to be admitted generally without the strictest proof.—Prof. Lindley: *Jameson's Journal*, No. 110.

EXPERIMENTAL VEGETATION.

A PAPER has been communicated to the Royal Society, by M. Ville, of Paris, entitled "Experimental Researches on Vegetation." The author, in this memoir, gives the results of a long series of experiments on the influence of ammonia on vegetation, which causes the latter to become remarkably active. In the proportion of four ten-thousandths, the influence of this gas shows itself at the end of eight or ten days, and from this time it manifests itself with a continually increasing intensity. The leaves, which at first were of a pale green, assume a deeper and deeper tint, and for a time become almost black; their petals are long and upright, and their surface wide and shining. In short, when vegetation has arrived at its proper period, the crop is found far beyond that of the same plants grown in pure air; and, weight for weight, they contain twice as much azote. Besides these general effects, there are others which are more variable, which depend upon particular conditions, but which are equally worthy of interest. In fact, by means of ammonia, we can not only stimulate vegetation, but, further, we can modify its course, delay the action of certain functions, or enlarge the development and the modification of certain organs. The author further remarks, that if its use be ill-directed, it may cause accidents. Those which have occurred in the course of his experiments appear to him

to throw an unexpected light upon the mechanism of the nutrition of plants. They have at least taught him at the expense of what care ammonia may become an auxiliary of vegetation. These experiments, which were made under the same conditions as those upon the absorption of azote, are then described, and their numerical results given. To the conclusions already stated, the author adds that there are periods to be selected for the employment of ammonia, during which this gas produces different effects. If we commence its use when several months intervene before the flowering season of the plants, it produces no disturbance—they follow the ordinary course of their vegetation. If its use be commenced at the time of flowering, this function is stopped or delayed, the plant covers itself with leaves, and if the flowering takes place all the flowers are barren.

The paper was illustrated by several elaborate drawings, and the apparatus employed by M. Ville in his experiments was exhibited, after the meeting, in the library of the Society.

ON THE IDENTITY OF A COLOURING MATTER PRESENT IN SEVERAL ANIMALS WITH THE CHLOROPHYLE OF PLANTS.

M. MAX SCHULTZE, of Greifswald, enumerates several animals of a green colour which are common in ditches and marshes—such as *Hydra viridis*, several green *Turbellariæ*, *Vortex viridis*, *Mesostomum viridatum* and *Derostomum cæcum;* and also several green infusoria, such as *Stentor polymorphus*, *Ophrydium versatile*, *Bursaria vernalis*, &c. The colour in these animals is afforded by minute green globules, about 0·016 inch in diameter, which are situated under the integument in the parenchyma of the animals. They are perfectly spherical, and exhibit within the green substance an extremely minute, colourless, and homogeneous nucleus; or they may consist of several minute green globules, grouped together in a mulberry form; in this latter case they arise from the division of a homogeneous vesicle.

This green colouring substance is not altered by dilute acids or alkaline solutions; by which it is distinguished from the green colouring matter of several Algæ, which, according to Nägeli, is changed into a yellow, orange, or red, by the same re-agents. Concentrated sulphuric and muriatic acids dissolve the colouring matter; the solution is of a beautiful green or bluish-green colour, unchanged by the action of heat; it is also dissolved by a concentrated solution of potass, by ammonia, alcohol, and ether, the colour precisely resembling that of a solution of chlorophyle.

Its development, also, is influenced in the same way as that of a vegetable chlorophyle by light; but animals containing it do not evolve oxygen, and the author thence concludes that the evolution of that gas is not solely dependent upon the chlorophyle in plants.

In *Vortex viridis*, the minute green globules, owing to their mutual compression, assume an hexagonal form; the green compartments thus formed are separated by an insterstitial colourless substance. The existence of a colourless membrane around each green vesicle may thence be deduced. This fact is further demonstrated in vesicles the green matter of which only partially fills the globular cavity.

With respect to the chemical composition of the membrane and of the nucleus of the vesicles in *Vortex viridis,* the results of the author's researches are limited to the following facts:—The solutions of potass and of ammonia, and sulphuric acid, after the extraction of the colouring matter, cause the membrane to swell out, in which the nucleus can no longer be recognised. The membrane becomes pale and finally disappears entirely, but especially so after long boiling. Acetic and chromic acids and alcohol do not affect the membrane and the nucleus. By solution of iodine the vesicle is coloured brown, the nucleus becomes more distinct, but its colour is unaltered. It cannot, consequently, be assimilated to the nucleus of the vegetable chlorophyle vesicle, which mostly consists of amylum.—*The Quarterly Journal of Microscopical Science,* No. 4.

LUMINOUS METEORS.

Mr. Grove has explained to the British Association the three opinions as to the possible origin of these objects. At one time it had been maintained that they were bodies projected upon the earth from the moon;—next it had been supposed that they had a chemical origin in our own atmosphere;—and lastly, it was held that they were probably planetary bodies, whose orbits traversing that of the earth when they met at a node, the planetary mass, falling into our atmosphere, ignited and put on one of the varied phases of a meteor. Mr. Grove stated that the first opinion was now universally abandoned; that the second, though still claiming supporters, was not considered the most probable; and that the third opinion was all but universally now received among scientific men as the most probable account of their origin. He fortified each of those statements, giving the leading reasons which led to the rejection or adoption of each.—Mr. Varley stated, that from his boyhood he had attended to these perplexing phenomena, and that the conclusion at which he had arrived was, that their origin was chemical, and that they had not that lateral motion which planetary bodies would unquestionably possess. He recollected his attention having been strongly drawn to them when yet a boy, by a large one descending nearly perpendicularly towards the earth in front of him, bursting, and the sparkles which fell from it also descending so perpendicularly as to induce him in his boyish eagerness to run forward with outstretched hand to endeavour to catch some of them. If the members would remember the very strong smell which hydrogen gas exhibited when prepared either from iron or from zinc, but especially and very distinguishably from iron,—and that almost every pool in summer was throwing up from its muddy bottom bubbles of carburetted or sulphuretted hydrogen,—they would feel small difficulty in admitting that metallic substances might be carried up with those light gases and accumulated in the upper parts of the atmosphere, and at length, influenced by electrical discharges or otherwise, descend to the earth, in the form of aerolites. He exemplified the power of lightning discharges to move terrestrial masses, by describing a heavy discharge which he had witnessed in

the Park, in London, on one occasion, when he had seen the fire to rise up from the earth to meet the descending lightning; and on going up to the place to examine it he found the ground all strewed over with a fine deposit of something as if sand had been uniformly sifted over it. Mr. Sollitt considered it not improbable that some aerolites were of the nature of planetary masses, across whose paths the earth passed in its yearly course, as described by Mr. Grove, while others had, as Mr. Varley maintained, an atmospheric and chemical origin. But he thought there was a third source, and that was the vitrification which electrical discharges constantly produced along the earthy substances which they traversed. Other members joined in the discussion; and the power of bodies containing the metals and metalloids to ignite when come into the atmosphere of the earth was not forgotten.—*Athenæum*, No. 1351.

ON THE PERIODIC RETURN OF THE MINIMUM OF SUN-SPOTS; THE AGREEMENT BETWEEN THOSE PERIODS AND THE VARIATIONS OF MAGNETIC DECLINATION. BY ROD. WOLF.

SINCE the time when the French Academy was pleased to take an interest in my observations establishing a relation between sun-spots and terrestrial magnetism, I have continued the study of these phenomena, and have examined at least four hundred volumes, in order to make myself acquainted with all the observations of sun-spots. The result is a memoir, which I shall shortly complete, the contents of which appear to me of sufficient importance to warrant my presenting a brief report of them. The memoir is divided into six sections, as follow:—

In the first chapter it is proved, by means of the six different epochs established by the minimum and maximum of sun-spots, that the mean duration of sun-spots may be fixed at 11·1 = 110·038 years, so that nine periods are exactly equivalent to a century.

In the second chapter it is proved, that in each century the years 0·00, 11·11, 22·22, 33·33, 44·44, 55·56, 66·67, 77·78, 88·89, correspond to the minimum of sun-spots. The interval between the minimum and the succeeding maximum varies. The mean is five years.

The third chapter contains an enumeration of all the observations of sun-spots from the time of Fabricius and Scheiner to Schwabe, always placed parallel with my periods. The agreement is astonishing.

The fourth chapter establishes the remarkable analogies between the sun-spots and the variable stars, from which it may be admissible to infer an intimate connexion between these singular phenomena.

The fifth chapter demonstrates that my period of 11·111 years coincides still more exactly with the variations of the magnetic declination than the period of $10\frac{1}{3}$ years assumed by M. Lamont. The magnetic variations even follow the sun-spots, not only in their regular changes, but also in all their smaller irregularities; and I think that this latter remark will suffice to prove this important relation.

The sixth chapter treats of a comparison between the solar period

and the meteorological indications contained in a Zurich register for the years 1000-1800. The result is, in accordance with the idea of Sir W. Herschel, that the years in which the spots are more numerous are also drier and more fertile than others ; the latter, on the contrary, being moister and stormy. The aurora borealis and earthquakes mentioned in that register predominate strikingly in the years of sun-spots.—*Comptes Rendus ; Philosophical Magazine*, No. 29.

SOLAR ECLIPSE.

THE Rev. W. R. Dawes, in a Letter to the Astronomical Society, says :—"Some suggestions have been made, and experiments tried, with the hope of imitating some of the phenomena of a total Solar Eclipse, and thus obtaining a sight of the red projections from the edge of the sun. It is, however, evident, that though the image of the sun itself may be completely and exactly concealed by some contrivance in the eye-piece, or permitted to pass through an aperture into a dark chamber, while the equatorial movement is regulated precisely to apparent solar time, yet there will remain a great, and, I fear, insurmountable obstacle, in the luminosity of the earth's atmosphere enlightened by the sun's rays. This difficulty appears to have been overlooked. If a telescope furnished with an eye-piece having a very small field, or half the field covered, be directed to the sky close to the border of the sun, the sun itself being just excluded, the glare is far too powerful to be endured by the eye without the interposition of a pretty deep tint of darkening glass. Such, at least, has been the case under the most favourable circumstances of clear and deep blue sky, during which I have been able to try the experiment. In the autumn of 1851, after my return from observing the total solar eclipse in Sweden, it occurred to me that the best chance of obtaining a sight of these phenomena might be afforded by taking advantage of that state of sky, lovely indeed, but too rarely seen in this country, where detached and sharply-defined clouds are slowly moving over the deep blue surface of the heavens. On two or three such occasions, the clock-movement of my equatorial having been carefully regulated, I watched the passing of well-defined clouds over the sun, which certainly seemed to produce a rather darker tint of sky in the immediate vicidity of the sun's edge than any artificial contrivance in the eye-piece. Yet the advantage gained was not such as to give the slightest hope of success. If it is at all possible to render these extremely delicate phenomena visible by artificial means, it will probably be accomplished by erecting a suitable instrument on the top of one of the highest accessible mountains in a fine climate, like that of Oroomiah in Persia, as described by Mr. Stoddard, where the smaller density of the atmosphere and its great dryness exceedingly diminish its illumination by the sun's rays. A telescope of very moderate size might answer the purpose, if equatorially mounted and driven accurately by clock-work."

CAUSES OF PHOSPHORESCENCE.

It is well known that the waters of the sea in some latitudes and under certain circumstances are phosphorescent, producing a light more or less brilliant. This remarkable phenomenon has always attracted the attention of travellers, and various have been the explanations they have offered.

Ehrenberg sums up, in the following manner, the important results of his labours:—

1. The phosphorescence of the sea appears to be owing solely to organized beings.
2. A very great number of organic and inorganic bodies shine in the water and out of the water, in different ways.
3. There is also a light from organized bodies, which is probably owing to vital action.
4. The active organic light shows itself frequently under the form of a simple flash, repeated from time to time, spontaneous or provoked. Often also it appears under the form of repeated sparks following each other in quick succession, under the influence of the will, and very similar to electric sparks. Often, but not always, there is formed by this production of sparks, a mucilaginous humour, gelatinous or aqueous, which is diffused around in great abundance, and is evidently placed in a secondary or passive state of phosphorescence, which continues a long time without requiring any new influence from the organic being, and even lasts after that has been divided or destroyed.

A light which, to the naked eye, appears uniform and tranquil, shows itself scintillating under the microscope.

5. The viscous humour which envelopes and penetrates the ovaries, seems to be especially susceptible of acquiring this communicated light, which is constantly reinforced by friction, and reappears even when it seems to have ceased.

May not the light emitted by living fishes, by Actinias, and by many other animals covered with mucosity, be sometimes merely communicated?

6. The relations which exist between the production of light and the sexual functions are evident in the Coleoptera, although the connexion of the small luminous sacs with the reproductive organs may remain concealed. With many marine hermaphrodite animals, phosphorescence appears to be a means of defence and protection analogous to those of another kind which exist in the *Bracchinus crepitans*, the cuttle-fish, the frog, or to the discharges of the torpedo. Whatever it may be, the air and the sea have their phosphorescence.
7. As yet it is only among the Annelids, and of them only in the Photocharis, that a peculiar phosphorescent organ has been discovered; it is external, tufted, frequently giving out light, similar to a thick cirrus, showing a largely cellular structure, and formed within of a mucilaginous substance. The expanded base of the marginal cirri in the Thaumantias (Acalephs) may be regarded as phosphorescent organs of an unusual kind. The ovaries are more probably luminous, passively, and in a secondary manner, although their minuteness and transparency have prevented our ascertaining whether the organs of phosphorescence are placed near them, as for instance in the *Polynoe* and *Pyrosomas*.
8. The production of light is evidently a vital act, very similar to the development of electricity; an act which, being completely individual, becomes more feeble, and ceases on too frequent repetition; which reappears after a short interval of repose; to the production of which, absolute integrity of the organism is not necessary, but which sometimes manifests direct connexions only with the nervous system.

The memoir of Meyen (*Beitrage sur Zoologie*) contains some important facts. It admits three kinds of phosphorescence:—1. The phenomenon is owing to a mucosity diffused in water, when it is bluish white; it is often seen in tropical parts, but rarely out in the open sea. This mode of phosphorescence may be produced artificially by washing or by crushing certain molluscs, either in sea water, or in fresh. 2. Phosphorescence results from certain living animals, and their luminous mucus. This continues even after the death of the

animal; it arises from a superficial oxidation of the mucous coating, and it can be reproduced after it seems extinct by passing the finger over the animal. The animals luminous in their secretions are Infusoria, Rotifera, Biphoræ, Medusæ, Acteria, Cuttle-fish, Certulariæ, Stennatulæ, Blanariæ, Crustacea, and Annelids. 3. The chief cause of phosphorescence is in some animals from the presence of one or more special organs. Of this number are the Pyrorama, and especially the Atlanticæ, whose light of greenish blue is very brilliant. Each individual carries behind its mouth a soft opaque substance, of a reddish-brown colour. Upon the body may be seen, by the microscope, thirty or forty red points, which substance produces the light.—*American Journal of Science and Arts,* No. 44.

EMBRYOLOGY.

Dr. Martin Barry, F.R.S., has communicated to the Royal Society a Supplementary Note to Papers published in the *Philosophical Transactions* for 1838, 1839, and 1840,* showing the confirmation of the principal facts there recorded, and pointing out a correspondence between certain structures connected with the Mammiferous Ovum and other Ova.

Referring to his account of the process of fecundation of the mammalian ovum, and the immediately succeeding phenomena, published in various papers in the *Philosophical Transactions,* the author calls attention to the confirmation which his views have received from corresponding observations made by subsequent inquirers on the ova of other animals. He more particularly adverts to a recently published memoir by Dr. Keber, in which that physiologist describes the penetration of the spermatozoon into the interior of the ovum, in *Unio* and *Amodonta,* through an aperture formed by dehiscence of its coats analogous to the micropyle in plants. The author is led to the following conclusions with reference to the structures connected with the ovum in different animals:—

1. That in the mammalia the vesicle he described as the fecundator of the Graafian follicle, and termed the ovisac, *does not remain permanently in the ovary, but is expelled and absorbed.* 2. That in the Bird, the ovum, when escaping from the ovary, is accompanied by the corresponding vesicle—the ovisac; and *that the ovisac becomes the shell-membrane of the Bird's egg.* 3. That the expelled and lost ovisac in the mammalia therefore corresponds to the shell-membrane in the Bird. 4. That after the formation of the ovum the albuminous contents of the ovisac in the mammalia correspond to the albumen in the Bird's egg. 5. That the author's retinacula in the mammalia, after all, find their analogue in the chalaze of the Bird; and that both have their origin in the granular contents of the ovisac, which at an early period are in appearance just the same in both. 6. That the shell-membrane of the Bird is thus a primary cell.

Dr. Barry points out the position which from his observations is to be assigned to the several parts of the ovum in the language of "cells;" and shows the presence of a plurality of ova in a Graafian follicle to be referable to the same cause as that producing more than one yelk (ovum) in the bird's egg.

* See "Year-Book of Facts, 1839," p. 158. "Year-Book, 1840," p. 177. "Year-Book, 1841," p. 181.

TABLE-MOVING.

During the first half of the year 1853, the public mind was strangely occupied, both at home and abroad, with "Table-Turning," the effect of which was, without due inquiry, referred to electricity, to magnetism, to attraction, to some unknown or hitherto unrecognised physical power able to affect inanimate bodies; to the revolution of the earth, and even to diabolical or supernatural agency. The several experiences in this "new science," as it was thoughtlessly termed, would fill a large volume; but we can only glance at its origin, and record a few of the many investigations by which this "startling revelation of popular credulity" was, like any other ghost of the brain, *laid* in the public mind.

The phenomenon was of American and German growth, as follows.

It appears that a young lady, recently arrived at Bremen from the United States, and keeping up a correspondence with her brother in the latter country, taught the commercial world at Bremen a new law in physics: she placed a circle of three gentlemen and five ladies around a small mahogany table; each person was at a distance of about two feet from the other; care was taken that the feet were not touching, nor that any part of the dress was in contact with that of another person; the table was round, and stood upon four solid legs. The experimentalists were nowhere in contact with each other, or with the table, but through the medium of their hands, which joined together, the little finger of each resting upon that of his neighbour. They remained quietly for about twenty minutes, when one lady, declaring that she felt ill, abruptly left her position, and thus broke the chain of communication. This was speedily formed again, but necessarily lengthened the experiment. At the end of half an hour, the party became wearied, and was on the point of breaking up, when a student, who formed one of the number, affirmed that he felt a magnetic influence in his right arm, and soon afterwards that it had extended to his left; in a short time all parties declared that they felt the same influence, still they were unwilling to proceed, when suddenly the whole party, as if with one accord, shrieked out, "It walks, it moves;" and such, in fact, was the case: the surface of the table first seemed to be lifted upwards, then to sink downwards, and at last it actually moved onwards.

The spectators took the chairs away from the experimentalists, who continued the chain, whilst the table marched northwards, turning round with a marvellous rapidity. Some of the party placing their arms in contact, the table arrested its steps, but no sooner had the proper chain been re-formed, than it began again its rapid movement. All Bremen had soon its tables in active exercise, some singular effects were produced, ladies fainted, strong men were seized with trembling, with chattering of the teeth; the nervous system of many received violent shocks. Leipsic, Munich, Vienna, all had their ponderous tales, and romantic legends enough to compose a sober philosophic treatise, sprinkled with startling mysteries and German metaphysical subtleties. A physician at Leipsic stated that he had seen diseases conveyed from one person forming the chain to another, and gouty old gentlemen had invariably impregnated their susceptible neighbours; the mayor of Pesth officially announced the death of a merchant passing through the town whilst assisting at an experiment; a young lady was so powerfully affected at Halle that for a time she became a maniac, and during her paroxysms she could make a table follow her in every direction in which she moved. The *Gazette* of Munich set people upon their guard, relating the melancholy death of an individual who was trying these experiments. These different accounts having found their way into the Parisian journals, the whole population became excited; a little pamphlet, written by M. Ferdinand Silon, in one day found nearly three thousand eager purchasers.

Early in May, a Correspondent of *Galignani's Messenger* described his experiences on the 30th of April, at the house of an American gentleman in Paris, where fifty persons were present, among whom were several *savans* of Paris, who participated in the performances, of which the following was the essential portion:—

First, a light mahogany tea-table, with six legs and two castors, was placed on the waxed floor of the salon, and the palms of the hands of four persons (two ladies and two gentlemen) were placed upon it. The formation of a chain or circle, connected by the touching of the little fingers—being a mere pedantry of those who know little of the subject—was not observed. In three minutes the table cracked, undulated, and then moved. On being directed by the will of one of the party, it moved along the floor slowly or rapidly, to the right or the left, forward or backward; when thus directed, it also rose on two legs, and resisted strong pressure before it would come down. While standing on two legs, it also turned round to the right or the left as directed by the will. A child of seven years, weighing thirty-five pounds, was put upon the table, and it then moved as before, though somewhat less rapidly. Similar experiments were made with other tables—one smaller and one larger. The former moved freely under the hands of two of the French scientific gentlemen, going round, and backward and forward, and rising upon two legs or one, in exact obedience to their volition. They fully admitted the astonishing reality. A large table, weighing seventy pounds, was tried, and the experiments were perfectly successful. It moved rapidly and freely, and rose upon two legs by the volition of one of the party—an effect equal to raising a weight of fifteen pounds! The experiments were repeated over and again. There was no doubt, I believe, in the mind of any person present as to the facts here stated. I need but add that these are only confirmations of what is familiarly known in the United States.

The mania soon reached England: a garbled adaptation from Silos's pamphlet was sold here in thousands; the newspapers teemed with the experiences of Correspondents; rules were laid down by "experienced turners;" and the delusion prospered until Mr. Faraday, in a communication to the *Times*, of June 29, disabused the public mind upon the subject. "I have been," said the Professor, "greatly startled by the revolution which this purely physical subject has made of the condition of the public mind. No doubt there are many persons who have formed a right judgment, or used a cautious reserve, for I know several such, and public communications have shown it to be so; but their number is almost as nothing to the great body who have believed and borne testimony, as I think, in the cause of error." The following extract from his letter to the *Times*, gives the substance of his experiments explaining the phenomenon:—

"Believing that the first cause assigned—namely, a *quasi* involuntary muscular action (for the effect is with many subject to the wish or will)—was the true cause, the first point was to prevent the mind of the turner having an undue influence over the effects produced in relation to the nature of the substances employed. A bundle of plates, consisting of sandpaper, millboard, glue, glass, plastic clay, tinfoil, cardboard, gutta percha, vulcanized caoutchouc, wood, and resinous cement, was therefore made up and tied together, and being placed on a table, under the hand of a turner, did not prevent the transmission of the power; the table turned or moved exactly as if the bundle had been away, to the full satisfaction of all present. The experiment was repeated, with various substances and persons, and at various times, with constant success; and henceforth no objection could be taken to the use of these substances in the construction of apparatus. The next point was to determine the place and source of motion—*i. e.*, whether the table moved the hand, or the hand moved the table; and for this purpose indicators were constructed. One of these consisted of a light lever, having its fulcrum on the table, its short arm attached to a pin fixed on a cardboard, which

could slip on the surface of the table, and its long arm projecting as an index of motion. It is evident that if the experimenter willed the table to move towards the left, and it did so move *before* the hands, placed at the time on the cardboard, then the index would move to the left also, the fulcrum going with the table. If the hands involuntarily moved towards the left *without* the table, the index would go towards the right; and, if neither table nor hands moved, the index would itself remain immovable. The result was, that when the parties saw the index, it remained very steady; when it was hidden from them, or they looked away from it, it wavered about, though they believed that they always pressed directly downwards; and when the table did not move, there was still a resultant of hand force in the direction in which it was wished the table should move, which, however, was exercised quite unwittingly by the party operating. This resultant it is which, in the course of the waiting time, while the fingers and hands become stiff, numb, and insensible by continued pressure, grows up to an amount sufficient to move the table or the substances pressed upon. But the most valuable effect of this test-apparatus (which was afterwards made more perfect and independent of the table) is the corrective power it possesses over the mind of the table-turner. As soon as the index is placed before the most earnest, and they perceive—as in my presence they have always done—that it tells truly whether they are pressing downwards only, or obliquely, then all effects of table-turning cease, even though the parties persevere, earnestly desiring motion, till they become weary and worn out. No prompting or checking of the hands is needed—*the power is gone;* and this only because the parties are made conscious of what they are really doing mechanically, and so are unable unwittingly to deceive themselves."

A more detailed Report of Mr. Faraday's "Experimental Investigation of Table-moving" was communicated by him to the *Athenæum*, No. 1340, July 2.

In the following week, the Paris Correspondent of the *Literary Gazette* writes :—"Professor Faraday's explanation of the mystery of table-turning has been translated into all the newspapers here, and has excited very great attention indeed. Gratitude is expressed to the eminent *savant* for the pains he has condescended to take to demonstrate, by actual experiment, that it is by physical power, and not by any magnetic fluid, that tables move on being pressed by the fingers. Complaints are made that the Academy of Sciences, or at least some member of it, did not take the trouble to do the same sort of thing when the moving mania was at its height. Had this been done, hundreds of intelligent men would have escaped the annoyance of having, somewhat too hastily, appeared to credit the prevalent delusion,—and some half-dozen scientific men of real eminence would not have grossly committed themselves to what it is now clear is a palpable absurdity. But, after all, Table-moving seems to have had its day in this city, as demonstrations of it have entirely ceased in private society, and as talking about it has become a bore."

Electrical Science.

ELECTRO-CHEMICAL DEPORTMENT OF OXYGEN.

M. VIARD concludes an elaborate investigation in the *Annales de Chimie*, as follows :—All that has hitherto been said of the elements of a battery, may with equal justice be repeated of any decomposing apparatus placed in the circuit of a battery; that is to say, that the presence of oxygen upon all the negative plates in the circuit has always the effect of increasing the current by augmenting the electro-motor force, unless the current be already very energetic in the absence of oxygen.

The following fact is also demonstrated by an experiment of Grove's. It was before said, that a pile of zinc, sulphuric acid, and platinized platinum, which alone could not decompose the water between two platinum plates, decomposed the same when a part of the negative pole of the element was covered with oxygen. Grove has shown that decomposition also takes place when oxygen is passed up the side of the negative plate of the voltameter: this fact ought evidently to receive a similar explanation. See the entire Memoir in the *Philosophical Magazine*, No. 39.

ON ELECTRICAL CURRENTS. BY PROFESSOR MATTEUCCI.

THIS paper, on the "Distribution of Electrical Currents in the Rotating Disc of M. Arago," has been read to the British Association. After the discovery of the induction between the electro-magnet and the closed conducting circuit, Faraday conceived the idea of applying the extremities of a galvanometer upon a disc of copper revolving in the neighbourhood of a magnet. In this way he found the electric currents, which were developed by the induction of the magnet, upon the disc, of which the points change successively according to the distance from the magnet; and by having recourse to the law of electro-magnetism, he arrived at an explanation of the magnetism of rotation of M. Arago. The author, after giving some further historical details, proceeded to point out how perplexing were the phenomena arising from the abrupt and numerous changes of direction. He then proceeds to state his own conception of the subject, and to detail the experimental researches which he had founded upon them; draws general conclusions from the experiments; and has drawn up a simple and perspicuous diagram, indicating the poles of the magnet, the revolving disc, and the curves which show the neutral points upon the disc, and those indicating the directions of the tangential forces, or those giving to the disc the tendency to revolve, and all of which he finds to have a fixed relation to the position of the poles of the magnet and the velocity of the rotation. The memoir is to be published entire.

TEMPERATURES OF CONDUCTORS OF ELECTRICAL CURRENTS.

M. RICHARD ADIE thus concludes a paper in the *Philosophical*

Magazine, No. 30 :—"On reflecting on the results of the experiments I have now submitted to your readers in connexion with this subject, the view I take of the supposed law of production of cold by electricity is, that it arises in the action of a battery where the heat developed by resistance to conduction is at its minimum ; *so that the caloric wanted for the chemical actions going on is exhibited in the joint through the power of a galvanic current of bringing to a state of equilibrium the temperatures in its circuit.* In Smee's battery, zinc is passing from a solid to a fluid state, and one of the elements of water is assuming a gaseous form."

THERMIC CONDUCTION IN METALS.

M. G. Gore, of Birmingham, states, as the result of a series of experiments detailed in the *Philosophical Magazine*, No. 40, that, taking the following series of metals, viz. copper, brass, iron, zinc, lead, and nickel-silver, as the order of their relative degrees of heat conductibility (determined by experiments), and comparing the results of the foregoing experiments with the relative conductibility of the corresponding metals for heat, we find that in every experiment, excepting three, heat travelled more rapidly from the better heat conductor to the worse than *vice versâ.* Also taking the following series, viz. copper, zinc, brass, iron, lead, and nickel-silver as the order of their relative degrees of electric conductibility, and comparing them in like manner, we find that in every experiment except that one, heat travelled more rapidly from the better electrical conductor to the worse than *vice versâ.* Also, in every case where wires of the same metal but of different diameters composed the arrangement, heat travelled more rapidly from the larger to the smaller wire than *vice versâ.*

MODIFICATION OF BUNSEN'S BATTERY.

From experiments by MM. Liais and Fleury, it has been found that when the diaphragm of a Bunsen battery is suppressed, the carbon being porous, and impregnated with nitric acid, the internal conductibility of the pile is increased fivefold. One simple experiment shows the fact—an element thus modified caused an electro-magnet to support nearly six tons. To arrive at the same result, by increasing the surface of the old pile, it was necessary to connect five Bunsen elements by their similar poles, so as to form one element of five times the surface. To keep the porous carbon impregnated with nitric acid, it is surrounded by a glass cylinder, so as to keep an annular space between, which is filled with nitric acid. The two cylinders are fastened together at their lower ends with clay or cement; the carbon being placed, a cavity may be drilled in it, and by introducing a diaphragm, and charging on the carbon side with concentrated sulphuric acid, and on the zinc side with dilute acid, as usual, the conductibility of the battery is almost the same as in the original Bunsen battery, but the tension is nearly doubled. One element behaves like a Bunsen battery of several elements, but costs much less.

INDUCTIVE ELECTRICAL MACHINES.

M. Fizeau, in a paper of the *Philosophical Magazine*, No. 35, gives the following, to furnish an idea of the increase of effect which he has obtained in his experiments. A galvanometer being placed in the circuit, the electricity produced by the machine was passed into rarefied air, when the beautiful phenomena of light recently studied by M. Quet were produced. When the machine acted under ordinary conditions, the needle of the galvanometer indicated a deviation of 8°. When the condenser was employed, the light produced acquired greater splendour, and the deviation of the needle reached 15°, the intensity of the current being consequently nearly doubled.—*Comptes Rendus.*

ELECTRICITY IN WEAVING.

It having been announced that the Chevalier Borelli, director of the Sardinian telegraphs, had invented a system of applying electricity to the Jacquard Loom for Weaving figured patterns, Mr. Nickeson has stated in the *Builder*, No. 555, that Mr. Woodcock, of Islington, explained, ten or twelve months previously, a plan for directing a Jacquard loom by the Electric current. His plan was to have the pattern painted with some non-conducting substance, such as varnish, on a metallic roller, connected with a galvanic battery: a row of wires was to pass from end to end of the roller, corresponding with the number of threads in the cloth, so that as the roller slowly revolved by the machinery, the threads would be raised or depressed, according as the current was cut off by the wires coming in contact with the painted pattern. By this means one application would work any number of machines. Mr. Woodcock also described the invention at the time to several gentlemen in London, and also wrote to several houses in Manchester, requesting them to take up the invention or render assistance to bring it out.

CONDUCTION OF ELECTRICITY BY FLAME AND GASES.

A somewhat extended series of researches have been recently carried out by M. Edmond Becquerel, with a view to determine the Conducting Power of Flame and of Hot Air. These investigations have led M. E. Becquerel to conceive that he has proved the conducting power of both for electricity. The apparatus employed—a platinum tube, with the conducting wire passing through it—appearing to offer some sources of error, Mr. Grove has adopted a somewhat different arrangement. This consisted of a glass tube, with two copper wires inserted through corks at either end; from these within the tube proceeded a piece of platinum wire, which, by connexion with the battery, could be brought to a state of intense ignition. In this state these were adjusted at the distance of 1-50th of an inch apart, and then connected with the powerful voltaic combination of Mr. Gassiot. Notwithstanding the proximity of the wires, no trace of electricity could be detected as passing through the interposed stratum of heated air, thereby proving the non-con-

ductibility of the gases while hot. The conducting power of flame has been already satisfactorily proved.—*Proceedings of the British Association.*

REMARKS ON ELECTRIC LIGHT. BY A. MASSON.

THE researches* which have already been made known by the author lead to the following results:—

A barometric vacuum offers a resistance to the passage of electric currents which increases with its length; this resistance is less in the partial vacuum produced by an air-pump.

A ponderable medium is necessary for the production of the electric light.

The author, together with M. Breguet,† has likewise succeeded in verifying most completely the identity of the luminous phenomena produced by induced currents and those which are caused by the discharge of a condenser. The former have the advantage of being continuous, the latter possess greater tension. Some recent experiments which they have made serve to establish the accuracy of these propositions.

The impossibility of making the current of a powerful inductive apparatus traverse a Torricellian vacuum three decimetres in length can only be attributed to the fact that the electrical tension is insufficient, since the discharge of a very small condenser illuminates the vacuum, and the authors have obtained currents for the vacuum of a barometer.

The following experiment made with improved instruments constructed by Ruhmkorff, confirms this assumption. The exhausted tube having been placed between the two poles of an induced current, the phenomena described in their memoir upon electrical spectres were produced; the entire vacuum was filled with a pale white phosphorescent light.

The tube presented the same appearance when perfectly isolated, on being connected at one end with a single pole of the induced current. In this case the current is interrupted, and the discharge from the opposite extremity of the tube must necessarily take place into the air. This curious fact is very analogous to those mentioned in the author's memoir on induction.

The rapid succession of discharges of an induced current, which, since the publication of Masson's researches on the physiological effects of electricity, has been so successfully applied in the treatment of paralysis, the continuity of the effects obtained by means of induced currents, render it a very desirable object to increase the tension of these currents, and the results already obtained in this direction by M. Ruhmkorff, justify the opinion that the electrical machines now in use will be superseded by an apparatus of induction.

In order to increase the power of such an apparatus, the authors have attempted to make the induced current of two coils traverse the

* Etudes de Photométrie Electrique. *Ann. de Chimie et de Phys.* sér. 3d, vols. xiv. xxx. xxxi.

† Mémoire sur l'Induction, *Ann. de Chimie et de Phys.* sér. 3, vol. iv.

same wire; the primary currents were kept apart and interrupted at the same instant.

When both the induced currents were in the same direction, the luminous phenomena in the vacuum indicated that the action of the combined currents was greater than that of a single current, but the increase of the action was not such as had been anticipated.

When the two currents traversed the same wire in opposite directions, they did not exercise any mutual influence on each other, and the results observed are not unimportant. The two balls forming the poles in the vacuum were surrounded, as well as their supports, by the violet-blue atmosphere, previously described by the author and M. Breguet in his *Memoire sur l'Induction.* The two poles were of the same substance, and between them was a reddish flame, which disappeared when the balls were brought nearer together; at a distance of four or five centimetres the space between the poles is perfectly dark, although they were surrounded by their luminous atmospheres. The luminous phenomena appeared to be more intense than in the former experiment.—*Comptes Rendus; Philosophical Magazine*, No. 34.

ROBERTS'S PATENT ELECTRIC LAMP.

AMONG a variety of important applications of electricity to which Mr. Roberts's patent is directed, one of the most useful is an improved Electric Lamp. The great difficulty of regulating the distance between the electrodes has hitherto proved a barrier to the extensive introduction of the invention for public and domestic purposes, and it has for many years engaged the attention of men of science. Mr. Roberts has already done much towards the general use of electricity, by pointing out the means of obtaining large supplies of the electric fluid at small cost; and in the ingenious arrangement by which he has surmounted the inherent difficulty of the lamp, to which we have adverted, and which we are about to describe, he has rendered great service in the cultivation of this branch of experimental philosophy.

The mode in which Mr. Roberts effects the permanent separation of the electrodes at the proper distance—usually termed the "striking distance"—is, to arrange the apparatus carrying one of the electrodes in such a manner that that electrode shall be released from the apparatus, and allowed to fall until its point comes in contact with the other electrode, and then be again taken hold of by the apparatus within which it is placed. This having been effected by means of another arrangement of the apparatus, either in connexion with the same or with the other electrode, one of the electrodes is drawn back until the points of the two electrodes shall be the proper and regulated distance from each other, as above described. The apparatus for producing these effects may be actuated either by an electric current or by clockwork. See details, with engravings, in the *Mechanics' Magazine,* No. 1536.

WATSON'S ELECTRIC LIGHT.

THIS new application of electricity, invented by Dr. Watson, has been exhibited in the immediate vicinity of Wandsworth. The great feature of the invention is, that the materials consumed in the production of electricity are employed for a profitable purpose, independent of that of illumination. Thus, while a most brilliant light is produced by galvanic action, materials are introduced into the battery by which pigments of the finest quality are obtained, and these are so valuable that they equal, if they do not exceed, the cost of the operation. The pigments are of course first obtained in a liquid state, but they pass through a filtering and drying process, which not only renders them available for ordinary purposes, but creates variety of tint when the colour is the same. If the result of the inventor's discovery answers his expectations, this double employment of electricity will be a valuable addition to practical science, since we may literally have light for nothing, the illuminator being paid with his own pigments.

Prussiate of potash gives, with iron, a blue colour, and chromate of potash with zinc a yellow; and mixing these salts in a battery of iron and zinc, the colour produced is a green.

A new electrode, and the use of an electro-magnet to regulate the changes in the current, so that the light can be burnt for any number of hours, are amongst the improvements claimed.

In a subsequent experiment in the carriage department of the Bazaar in King-street, Portman-square, the light emanating from a simple conductor, having a small metal reflector placed behind, was fixed at the upper part of one end of the building. A Maynooth battery of 41 cells, fitted up in an adjoining outhouse, supplied the electric fluid. In its bulk, the light appeared hardly so large as a walnut, yet the whole of the building was well illuminated, and any one could read with facility small writing at a distance of 137 yards. At times, the whole body of light filling the building appeared to assume distinct colours or tints, one of the capabilities of the process which the inventors intend hereafter more fully to develop. Dr. Watson and Mr. Prosser were in attendance, and explained the nature of the apparatus, which is stated to have appeared very simple.

ELECTRIC GAS.

THIS discovery, the conversion of water by a simple magneto-electric process of decomposition, into a non-explosive illuminating gas, is thus described in the *Literary Gazette*, No. 1905:—An ingeniously constructed magneto-electric machine of large size is employed in effecting to all appearance the decomposition of a fluid contained in the number of bottles. The gas escaping from these is passed through some hydro-carbon compound to give it illuminating power, and it is collected in a gasometer and burnt at once in an ordinary Leslie gas-burner. It is said to be oxygen and hydrogen derived from the decomposition of water, with their explosive property destroyed! These gases, it may be well to explain, as liberated from water, exist in proportions forming a

mixture which is violently explosive on the application of a spark; yet here is a gas burning quietly from an ordinary burner, and giving out a flame of the same illuminating power as common coal gas. The gist of the invention is this. Some preparation—here is the secret—costing twopence to 1000 cubic feet of gas, is used, which, being held in solution in the water, is said to destroy the explosive property of the liberated gases. Now the gases from water should exist in proportions of 88·9 of oxygen, and 11·1 of hydrogen; but an analysis of this gas by Mr. Holmes, Panopticon Professor of Chemistry, was shown to us, giving oxygen about 12, and hydrogen about 82. It is clear, therefore, that *water* is not decomposed; and the only inference we can draw from this is, that the Electric Gas is derived simply from the preparation *added* to the water.

The Panopticon Professor is stated to have made one discovery which will greatly delight Professor Schonbein, the discoverer of Ozone. He has determined its existence in this electric gas *quantitatively*, and shown that the gases are non-explosive because ozone is present in them.

EXTRAORDINARY EFFECT OF ELECTRICITY.

A most extraordinary effect, produced by Electricity, has just happened in one of the Electric Telegraph offices in France. A gentleman employed in one of the principal offices was in communication with one of his colleagues, when the electric wire for the purpose of transmitting intelligence happened to relax, and to come in contact with his arm. The electric current was passing through it, and the *employé* sustained a violent shock, which, raising him from his chair, violently threw him through a window opening on a garden. When he recovered his senses, he could not recollect his adventure, and could only be convinced of it by perceiving that his hair and beard, which were previously of a beautiful jet black, had become in various places as white as snow. It devolves on scientific men to explain this phenomenon, which will form an epoch in the history of electricity.—*Courrier de l'Europe.*

ELECTRIC SEMAPHORE.

Mr. W. Sykes Ward has made a communication to the British Association, to show that a Semaphore consisting of a disc might be constructed to make a partial revolution, so as to take different positions exhibiting three distinct signals; and that its motion might be regulated by electro-magnets worked by a continuous supplemental battery, of which the circuit is opened, closed, and changed by an electro-dynamic coil, which is moved by means of a current communication from a distant station through a single wire. Thus what is mechanically effected at the distance of about half a mile may, by the proposed apparatus, be effected at any required distance, and at any number of stations simultaneously.

ELECTRIC TELEGRAPH WITHOUT WIRES.

MR. LINDSAY, of Dundee, a mathematical teacher, who has for many years followed up numerous experiments on Galvanic Electricity and the Telegraph, has delivered lectures in Glasgow, accompanied by experiments, to show the possibility of rendering the action complete without wires, merely employing the water of the ocean as a conducting medium.

APPLICATION OF THE ELECTRIC TELEGRAPH TO THE DETERMINATION OF THE LONGITUDE.

IN May last, an extensive series of experiments was instituted with the Electric Telegraph, in order to determine the Longitude of Cambridge Observatory from that of Greenwich. It will be seen from the account of these experiments which we now give, and which was communicated by Professor Challis, of the Cambridge Observatory, in a letter to the Editor of the *Times*, that they have been conducted on a very comprehensive scale; chronometers, astronomical clocks, and transit instruments having been employed, and every precaution taken to eliminate the "personal" and other errors from the several observations. The result is one of considerable importance, as establishing the efficiency of the method of telegraphic signals in the determination of differences of longitude, which will lead, no doubt, to the immediate revision and critical correction of tables of longitude, and to other obvious objects of interest and utility in science and in engineering.

The letter is dated from Cambridge Observatory, May 19, and states that this is the first instance of the Electric Telegraph being applied to such a purpose in England, and the Professor believes he may add, in Europe. The method was first put in practice by our enterprising scientific brethren of the United States of America; and there can be little doubt that, from its practicability and accuracy, it will be extensively used for geographically connecting astronomical observatories.

Mr. Challis describes the operations in these terms:

"The plan of making the experiment was arranged by the Astronomer Royal, and in principle is very simple. Two needles, one at the Greenwich Observatory and the other at Cambridge, were made to start by completing the galvanic circuit at either station. This was the signal. The instants of starting, which practically are identical, were noted at the two stations. The noted times, reduced exactly to Greenwich Observatory time and Cambridge Observatory time, give by comparison the longitude of the latter Observatory from Greenwich. The Astronomer Royal is provided with means on the spot of transmitting such signals along any line of railway that is telegraphically connected with Lothbury, and his signal-needle is very conveniently attached to the case of the transit-clock. Not having the same means at command, I was obliged to transfer the Cambridge Observatory time, by chronometers, to the Telegraph-office of the railway station at Cambridge, and to note the signal

times by a chronometer. Some little inconvenience was felt from the noise inseparable from a railway station.

"The Electric Telegraph Company most promptly and liberally permitted me to avail myself of their telegraphic communication with Cambridge. Mr. Edwin Clark, chief engineer, kindly placed a wire exclusively at our disposal, and Mr. Sach, engineer of the Eastern Counties telegraph, made the requisite arrangements of the galvanic apparatus, and was present during the whole of the observations, making the connexions proper for giving or receiving signals.

"On May 17, from eleven to twelve P.M., 151 signals were transmitted in 29 batches, intervals between the batches being allowed for the observers to take rest, and for giving warning of the number of signals that were coming. The signals were sent alternately from the two stations during intervals of a quarter of an hour. On May 18, from eleven to twelve P.M., 139 signals were similarly sent in 22 batches, the Cambridge and Greenwich observers having in the meantime changed places. This was done to eliminate in the final result the effect of any constant error or personal equation, as it is termed, between the noted times of the two observers. It was also arranged that, if the state of the sky permitted, the same stars should be observed for clock errors by both observers on the two days, for the purpose of eliminating personal equation from the clock errors. The nights of May 17 and 18 allowed of this being done. Each station had a signal-giver in a separate part of the room from that occupied by the signal-observer. The signal-giver at Greenwich had the means of observing the passage of a star across the field of the transit-telescope, and giving signals at the same time, and in several instances his signals were made at the instants of transit of a star across the wires of the telescope, so that a transit observation taken at Greenwich was actually recorded at Cambridge.

"Too little time has elapsed since the observations were made to allow of stating the numerical result. I consider, however, the experiment to have sufficiently proved the practicability and efficiency of the method of telegraphic signals for the determination of terrestrial longitudes."—*Mechanics' Magazine*, No. 1555.

ELECTRIC TIME-BALL AT THE ROYAL OBSERVATORY, EDINBURGH.

A TIME-BALL, similar to that at the Royal Observatory, Greenwich, the Strand, and other places, has been erected on the top of Nelson's Monument, Edinburgh, with electric communication to the Royal Observatory there. The machinery has been constructed by Messrs. Maudslay and Field.

The mode hitherto adopted for setting chronometers has been to adjust a clock in one of the out-buildings of the Observatory daily to the true time, and the various chronometer makers of Edinburgh and Leith, the mariners in the Docks and Firth, and others, have sent messengers with portable time-pieces to procure the indications of the clock. But this method evidently gave excessive trouble to all concerned, and marred the result most prejudicially; for when a

chronometer is carried all the way from Leith to the Calton-hill and back, the shaking that it gets must greatly alter its rate.

The earliest signal-balls which were made, though provided with ropes passing over pulleys, by which they were enabled in their descent to raise a series of weights in order to check in a gradual manner the velocity of their fall, were yet invariably found, after a short time, to pull, or to smash themselves to pieces. Steel springs were next tried, to break the force of the concussion, but were pretty sure to be themselves snapped with a heavy ball, while a light one would not descend quick enough on a windy day. Recourse was finally had to compressed air, a spring of perfect temper, never injured by time, and capable of any degree of delicacy at first, and any amount of violent resistance at last.

To carry out this principle, a staff was attached to the ball below, terminating in a piston, which in the course of its descent entered an accurately-turned cylinder, and compressing the air therein, was gradually brought to rest. Were the cylinder quite closed at the bottom, the spring of the included air might be greater than required, and also have a tendency to throw the ball up the mast again, which would be somewhat troublesome to observers. But by simply opening a graduated aperture below, so as to admit of the air partially escaping as it is compressed, the strength of the spring is diminished, and by the time that the piston has descended to the lowest point, there is so little air remaining in the cylinder, and it is still escaping so fast, that there is no power left to make the ball rebound.

Thus the time-ball is made to descend without injuring the building or spoiling itself; and the trigger apparatus, by which the detent that holds the ball when hauled to the top of the mast is unlocked, being very nicely adjusted, and observers being duly cautioned to look to the instant of *separation of the ball from the cross-staff*, the descent —that is, this first part of it—is as instantaneous as need be. In the next place, the trigger being pulled, not by the finger of a person at the ball, but by an electro-magnet which is instantaneously set in action by the contact made at the end of a wire led into the walls of the Observatory, and brought immediately before the transit clock itself; the instant for the signal outside can be conveyed to the undeviating mechanism there with all the refinement of a chamber experiment, and to the utmost extent of the observer's knowledge of the real time by the stars, as obtained the previous night, and continued on by the clock.

For raising the ball, a plan has been proposed, by which a weight having been wound up at *any previous hour of the day or night*, then on electrical contact being made at the Observatory by the astronomer at a precise moment, that weight is unlocked, immediately descends, and hauls up the ball. Next at five, or any other number of minutes, a second contact being made on another wire, lets the ball down.

It has been suggested to place the Observatory at Edinburgh in galvanic connexion with that at Greenwich, so that Greenwich

mean time, which mariners always require, and Edinburgh citizens do at present, should be exhib.ted in place of the local time; and this, it is believed, will shortly[1] be done.—*Abridged from the Scotsman.*

TELEGRAPHIC LONGITUDE OF BRUSSELS.

WITHIN a few weeks of the close of 1853, the Submarine Telegraph has been employed in a determination of considerable importance to Astronomy and Geodesy, namely, the ascertaining of the difference of longitude between the Observatories of Greenwich and Brussels. The galvanic telegraph had been used for similar determinations in America; but to a very late period it had never been so applied in Europe.

Measures were taken for determining the difference of longitude of Greenwich and Brussels; and M. Quetelet, the Belgian astronomer, took every step proper for insuring the utmost accuracy to this determination. A wire was laid from the telegraph office in Brussels to a galvanic needle near the transit-clock in the Brussels Observatory; so that an unbroken metallic communication was made from the transit-room at Greenwich, through the Dover and Ostend wire, to the transit room at Brussels; and the risks attending the conveyance of chronometers were absolutely removed. Batteries were contributed by the Submarine and European Company at Brussels, and by the Electric Telegraph Company at Greenwich. An assistant of the Brussels Observatory was sent to Greenwich, and an assistant of the Greenwich Observatory to Brussels; and, when half the operation was thus completed, the assistants returned to their original posts for the completion of the remaining part. This arrangement (suggested by Prof. Challis, in the operations for the longitude of Cambridge) was primarily intended for the elimination of those errors arising from the peculiarities in the modes of observation by different persons, which are known by the technical name of "personal equation;" but it also had the advantage of communicating to M. Quetelet at Brussels and his assistant at Greenwich all the results of former Greenwich experience; at the same time that it permitted the introduction of changes suggested by the Belgian astronomers, several of which had been adopted with great advantage.

The result of these arrangements is, that about 3000 signals have been observed simultaneously at the two Observatories, for the comparison of the two transit-clocks. The whole of these are available for certain physical determinations, one of which is the time occupied by the passage of the galvanic pulse from Greenwich to Brussels, or *vice versâ*. As far as the observations have yet been reduced, it appears that this time is pretty accurately *one-tenth of a second.* Rapid as is the velocity which this implies (about 2700 miles per second, supposing the velocity uniform along the whole line), it is much less than that found in the experiments with Edinburgh (about 7600 miles per second), and still less than that determined on some of the American lines (about 18,000 miles per second). The difference undoubtedly depends on the circumstance that the

greater part of the line to Brussels is subterranean and submarine, which position of the wires, without any degree impairing the insulation (which, perhaps, is the most perfect in the world), does, by an ill-understood effect of induction, greatly retard the speed of transit.

The whole of the signals were not, however, available for measuring the difference of longitude. In order to ascertain this difference, it is necessary not only to compare the two transit-clocks by the galvanic signals, but also to discover the relation of the time shown by each transit clock to the sidereal time at its locality by means of observations of the meridian passages of stars. Considering the perfection of the galvanic comparisons of clocks, the astronomers laid it down as a fundamental principle, that none of these comparisons should be retained as valid unless the meridian-passages of stars had been observed at both stations very shortly before or after the comparisons. The result of this weeding-out is that about 1000 signals are left available for the measure of difference of longitude, in combination with about 150 nearly simultaneous observations of meridian passages of the same stars at the two Observatories, on seven days. There can be no doubt that this determination will be very greatly superior in accuracy to any determination of difference of longitude hitherto made.

The example has now been fairly set of employing the telegraph wires for the measure of the difference of longitude of Observatories. The process is inexpensive and gives very little trouble, and the details of the mode of operation are reduced to a very easy routine. We may anticipate that in no long time Greenwich will be connected in the same way with the French and Dutch Observatories; that these will be similarly connected with more distant points; and that thus all the principal places of Europe will soon be included in one great system of ascertained differences of astronomical longitude.

The operation to which we have referred would have failed totally if the transmission of the signals by unbroken wires at Ostend had not been permitted. Perhaps we can hardly hope that the jealousy of Continental Governments, in regard to the use of the telegraph wires, will permit us immediately to extend the scientific communication without a break at the political frontiers. If, however, this can be conceded, there appears to be no reason why the lines should not at one stretch be greatly extended. Having respect to the geographical distance and the ascertained insulation of the wires, we can assert that Altona and Berlin are within easy distance; and it is not improbable that Vienna may be reached at once by a signal from Greenwich.

The immediate result of such a connexion of different Observatories is the power of bringing into combination the astronomical observations made at different Observatories as if they were made at one. The want of accurate determination of difference of longitude for that purpose is at this moment practically felt. In the preparation of new lunar tables, Prof. Hansen experiences a difficulty in combining the observations at Dorpat with those at Greenwich, in

consequence (partly) of an uncertainty in the longitude. But this is not the principal use. Nearly the whole of Europe (except Spain) is now covered with a net of geodetic triangulation, uniting the western coasts of Ireland and France with the interior of Russia and the borders of Turkey. The combination of the geodetic measure with the ascertained difference of astronomical longitude affords one of the best materials for the measure of the earth. And it so happens that Greenwich is a very important point in these measures. One great European arc of parallel may be expected to commence at Valentia in Ireland (which was connected with Greenwich by the Astronomer Royal several years ago) and to extend far into Russia. Another great arc commences at Marennes on the west coast of France, and has been carried to Padua and Orsova: the astronomical part of it, however, is far from perfect, and (as has been pointed out by M. Struve) it will be absolutely necessary, in order to give this arc its full value, to determine accurately the longitude of Marennes from Greenwich, because the longitude of the eastern extremity will probably be made to depend on Russian observations, which are referred immediately to Greenwich by the great chronometrical operations connecting Greenwich with Altona and Pulkowa.—*Abridged from the Athenæum*, January 14, 1854.

PROGRESS OF THE ELECTRIC TELEGRAPH.

We select and abridge the following *resumé* from the *Mercantile Journal* of Jan. 3, 1854:—

English and Continental Lines.—The submarine lines of Electric Telegraph now in daily operation are, the line between Dover and Calais, 20 miles; between Dover and Belgium, 70 miles; between Orfordness, on the coast of Suffolk, and Holland, 115 miles; between Donaghadee and Portpatrick and the Great and Little Belts, a total extent of 255 miles. This extent of submarine telegraph is the result of English enterprise; it being a singular fact that no other European kingdom possesses, or has promoted up to the present moment, this magnificent means of international communication. By the Mediterranean electric telegraph, contracts for which have been entered into, England will be united with France, Piedmont, Corsica, Sardinia, Algeria, and Egypt—Europe with Africa—The East Indies with Australia. This, again, is under the auspices of English enterprise, with the concurrence and support of the various foreign Governments.

Wires are laid in Pall Mall, St. James's-street, and Charing Cross, to the principal Club-houses, the Government Offices, the Houses of Parliament, and Buckingham Palace, so that instant and direct communication may be made, without dispatching messengers to the Central Office, with all parts of the European Continent reached by the Electric Telegraph.

On the roof of the Office in the Strand, a Time-ball indicates one o'clock simultaneously with the ball on the Observatory at Greenwich, and a clock erected upon a pillar in the street opposite tells Greenwich time by the same apparatus. It is under consideration to establish a similar contrivance at different parts of the coast, so as to enable masters of vessels to get the true time while on their way to port; and in foggy weather, the electric spark is to fire a cannon precisely at one o'clock, instead of dropping a ball. Soon we shall have to report that the difference of longitude between the Observatories of Greenwich and Paris has been determined by telegraph. The difference, as at present known, is nine minutes twenty seconds and a-half; should it be confirmed, it will say something for the accuracy of past observations.

England is at present in communication with the Continent by three submarine telegraphs, viz.:—(1) *viâ* Hague, (2) *viâ* Calais, (3) *viâ* Ostend, by any of which can messages be transmitted to every town in Europe.

The establishment of the Electric Telegraph in France has been slower than in other countries; but there are now lines which radiate from Paris to Bordeaux, Marseilles, Lyons, Toulouse, Havre, Dieppe, Calais, and Strasbourg: and, by the close of 1854, the chief towns of each department will be connected with the Ministry of the Interior. The Government is master of all the lines, by way of Strasbourg; they now reach Germany independently of Belgium; and in that city the French office and the Baden offices are side by side. Besides their own private despatches, no secret messages are sent, except certain diplomatic matters, and the news brought by the Indian mail to Marseilles. The latter is at once flashed onwards to London. Paris time is adopted on the lines all over France.

Most of this progress has been accomplished since 1850, as also the laying down of the under-sea communications. It was in August, 1850, that the possibility of sending a message through the Straits of Dover was demonstrated. The experiment was repeated toward the close of 1851 with entire success, which has not yet been once interrupted. Future historians will perhaps be struck by the fact, that the first news sent by the wire was of the famous *coup d'état* of the 2nd December. If it was then remarked that England had lost her insular position, what shall be said now, when we have a second wire running to Middlekirk, near Ostend, and a third from Orfordness to Scheveningen, on the Dutch coast, 119 miles in length? The latter wire was worthily inaugurated on the 14th June last, by the flashing across of the King of Holland's opening speech to his Chambers. Then there are two wires across the Irish Channel; and a third is talked of, to run from the Mull of Cantyre to Fairhead. Ireland, too, is less insulated than before. By means of the under-sea wires, we can now communicate with most parts of the Continent. The Dutch line gives us the shortest route to Copenhagen; and now that wires are sunk across the Great and Little Belts, we can hold telegraphic talk with the Danish capital. Through the Belgian wire we reach Prussia, thence to Cracow and Warsaw, and on to St. Petersburg: or we may diverge the course of the message to Vienna, and have it forwarded to Trieste, 325 miles further, where it will overtake the Indian mail. The Czar is stretching wires from St. Petersburg to Moscow, and to his ports on the Baltic and Black Seas. Perth, on the Tay, may, if she will, hold a "crack" with Pesth on the Danube; and Manchester ask Marseilles for the earliest quotations of Egyptian cotton.

At first, most of the German wires were laid under ground, but in many places those stretched on posts have been substituted, as more generally serviceable. They are no longer confined to the railways, but are carried on such routes as are most suitable; and soon the miles of telegraph will outnumber those of railways. Austria has about 4000 miles of telegraph, and the other parts of Germany about as many. The wires are penetrating the valleys of Switzerland, and creeping up the slopes of the Alps; Spain has found out their use but to a very limited extent; Italy has a few score miles: and in Piedmont, Mons. Borelli, the engineer, has done wonders. Pending the construction of the railway between Turin and Genoa, it was thought desirable to connect the two cities by telegraph; and to effect this, the wires were carried over precipitous steeps, stretched across valleys nearly a mile in width, and buried in some places, where no other mode was possible. The way in which the difficulties of the ground are overcome is said to excel anything similar in Europe. The system of fixing the pole on the summit of mountains, distances apart varying from 2700 to 4000 feet, without intermediate support, has been for the first time adopted and successfully carried into execution, with the precautions best calculated to prevent any interruption in the communications in case of any breakage of wire taking place. The telegraph has been some time at work, and is found to act with great promptitude and precision. This method, very useful in mountainous countries, has the advantage of shortening the distances, reducing the expenses, and securing a more complete insulation.

The Italian wires are to be connected with Corsica and Sardinia by lines sunk in the dividing channels; and from the Southernmost cape of Sardinia they will be carried to Africa, striking the mainland a few miles west of Tunis, from which point it will not be difficult to reach Algeria, Egypt, and, ultimately, India. One stage, from the Nile to the Red Sea, will ere long be complete.

Continued from the coast of Africa to Bombay, the electric link is to be connected with the 3000 miles of telegraph now constructing in the Indian empire;

and thence to Australia, to supply which, some time since, the Australian Telegraph Company, for communication with India, Van Diemen's Land, and the whole interior of New South Wales, was projected; but the credit of which appears likely to be taken from the mother country by the Americans, who, it is said, propose to execute it. Nearer home the telegraph wires have been completed between Cork, Dublin, Belfast, and Killarney. They have been carried from Cornhill to the London Docks, and are being taken to the end of Scotland.

The Telegraph has now approached the confines of Turkey, and it is to be immediately introduced into that kingdom; and London will soon be placed in instantaneous communication with Constantinople. The aggregate distance from Constantinople across Asia Minor to Scanderoon, from thence through Palestine to El Arish; and from El Arish to Suez, is not greater than from Bombay to Calcutta; and we feel hopeful that, within a year or two after the telegraph has reached Constantinople, from the various capitals of Europe, it will be stretched down to Suez, and thus give the Porte instantaneous information of whatever may be passing in its Asiatic and African dominions. News would thus reach Suez from London daily; and the magnificent steamers which are now being constructed will easily complete the voyage between that port and Bombay in twelve days. Within an hour, the intelligence which had arrived at Bombay might be circulated through every Presidency town; and thus, while we are waiting for the submarine telegraph, which is to reduce the distance between Calcutta and London to the compass of an hour or two, we may establish a communication of only thirteen days between our Indian dependency and the mother country.

The cable wonld pass from the Land's End to Gibraltar, from thence to Malta and on to Alexandria. At Suez, the cable would again be planted on our own ground, and extended to Aden, and from Aden across to Bombay. Gigantic as this plan may seem, it cannot, after the successful experiment between Dover and Calais, be considered more visionary, or even more remote, than the navigation of our Indian seas by large steamers appeared to be after the Atlantic had been bridged by the *Great Western*. The expense of such a line would not exceed half a million sterling, and the whole cost of it would be subscribed in an hour in London, for any Company to whom its profits might be assigned.

THE ELECTRIC TELEGRAPH IN THE EAST INDIES,

In India, the Electric Telegraph is making rapid strides. The great line is to proceed from Calcutta by the Grand Trunk Road to a point opposite Benares, when it will either cross the Ganges to that place, and extend along the Trunk Road to Allahabad, with a branch to Mirzapore, or it will continue along the right bank of the Ganges through Mirzapore, and cross the Jumna to Allahabad, with a branch to Benares. From Allahabad the line will pursue its onward course to Cawnpore, Bowgong, Agra, Allyghur, Meerut, Delhi, Umballa, Loodianah, Jullindar, Umritsir, and Lahore, the whole distance being 1280 miles—that is, from Calcutta to Allahabad, 492; thence to Agra, 266; Agra to Delhi, *via* Meerut, 180; and from that city to Lahore, 352. From Agra there will be a branch to Bombay, *via* Indore, for which more than 350 miles of wire have been forwarded; the rest will be supplied from Bombay. Ten depôts have been established along the line, and ten separate working parties commenced operations on the 15th of October. It is expected that each party will be able to construct six miles of telegraph a-day; but we fear that those who made this calculation have overlooked the "passive resistance of circumstances," so powerful in that country.

THE ELECTRIC TELEGRAPH IN THE UNITED STATES.

It is only eight years since the first Electric Telegraph Line was erected in the United States; that being the one between Baltimore and Washington. At the present time, all the important cities in that country and Canada are united together by 25,000 miles of metallic electric nerves. If an important event transpires in any city of the Union in the evening, an account of it is read next day by the people throughout the country.

The extent of telegraphs in the United States and Canada is increasing every day; the capital involved is upwards of £1,000,000 sterling. To work these lines takes annually 720 tons of zinc, worth £12,000; more than 1,000,000 lbs. of nitric acid, worth £24,000; and £6000 worth of mercury, besides a considerable value of sulphuric acid, &c. On the line from Pittsburg to Cincinnati alone there were transmitted, in the year 1850, 364,559 paid despatches, and the revenue received was £73,278. The most distant points in communication are the cities of Halifax (Nova Scotia), and Quebec, with New Orleans, nearly 2000 miles intervening by the telegraphic routes between the former and the latter city. Between New York and New Orleans, a distance of nearly 3000 miles by the wires, messages are delivered in one hour. The towns and villages in the Union and neighbouring British provinces, accommodated with telegraphic stations, amount nearly to 500. In New York and Boston, all the fire-stations are connected by telegraph, and alarms are made known with a promptitude that averts much mischief. Private telegraphs, too, are greatly used in the large trading towns.

By aid of the Telegraph, the Government at Washington can almost instantaneously communicate with all parts of the Republic —north, south, east, and west. That vast country, 3000 miles long, and 3000 miles broad, can be as easily managed and governed by aid of the telegraph as a single city. But the telegraph system of the United States is only in its infancy.

A long experience in America, with some dozen different lines of telegraph, establishes the fact, that the velocity of the galvanic current is there about 15,400 miles per second. The time of transit between Boston and Bangor was recently measured, and the result was, that the time occupied in the transmission was one-sixteenth-thousandth part of a second! and that the velocity of the electric fluid was at the rate of 16,000 miles per second, which is about 600 miles per second more than the average of other experiments in that country.

THE BRITISH ELECTRIC TELEGRAPH COMPANY'S LINES.

Some interesting facts touching the progress of the Telegraph Wires through the country have been stated at Leeds, at a meeting of the British Electric Telegraph Company. Liverpool and Glasgow are now linked together, and Hull and Greenock have since been brought within the communication. In fifty other towns, stations have been already established. The revenue of the company from messages alone exceeds £6000 a-year, and now that they have power

to erect stations on every highway in the kingdom, their extension will be merely a question of time. Telegraphic despatches are now daily sent from the Leeds office through 330 continuous miles of wire, without any stoppage or reading off, and that altogether irrespective of the state of the atmosphere.

It was in 1837 that Wheatstone took out his first patent, and its first application in this country was made on the short railway from London to Blackwall. Now, as appears by the Electric Telegraph Company's Report, we have nearly 6000 miles of telegraph, comprising more than 21,000 miles of wire, almost enough to stretch round the globe; and for the despatch service, there are 150 stations besides those in London. From the central office, behind the Bank of England, communications are established with all parts of the kingdom, along the lines of railway, and messages may be sent at any hour of the day or night. The railway business alone keeps the telegraph clerks pretty actively employed; and when to this are added the messages of the Government and the general public, some idea may be formed of the amount of work to be done. During the elections of 1852, the state of the poll of every hour was transmitted to head-quarters. More than 10,000 such messages were sent in that short but eventful period.

The public generally selects the shortest route for the transmission of messages, under the impression that it is also the quickest—an idea by no means correct with respect to telegraphic despatches. It is well known that, in telegraphy, distance is annihilated, and that, with an uninterrupted communication, and the same instruments at work, a despatch may be transmitted as quickly through five hundred as five miles; and experience has shown that messages for Vienna and Trieste, forwarded by the shortest route (*via* Calais and France), have often reached their destination ten to twelve hours later than by the longer route in point of distance (*via* Hague and Berlin); while despatches for Hamburg have frequently arrived much earlier, *via* Berlin, than by the route of Hamburg, which is two hundred miles shorter.—*Rankine's Report.*

STATIC ELECTRICITY.

PROFESSOR FARADAY has delivered, at the Royal Institution, a course of four lectures on Static Electricity; in three of which he explained the phenomena of the excitation of the force, its general character, and the properties of attraction and induction; and in the fourth and concluding lecture, he directed attention particularly to the property of induction and its conditions; the subject being illustrated by numerous well-contrived experiments. In the second lecture, though adopting the terms "positive" and "negative" in distinguishing the electricity excited by glass over that excited by gutta percha and resinous bodies, Professor Faraday expressed himself strongly opposed to the Franklinian theory, from which these terms were derived. According to Franklin's view of the nature of electrical excitement, it arises from the disturbance, by friction or other means, of the natural quantity of one electric fluid which is

possessed by all bodies; an excited piece of glass having more than its natural share, which has been taken from the rubber, the latter being, consequently, in a minus or negative state. This theory Professor Faraday considers to be opposed to the distinct characteristications of the two forces; and in his opinion it is impossible to deprive any body of electricity, and reduce it to the minus state of Franklin's hypothesis.

In the concluding lecture, Professor Faraday noticed an important mistake into which many electricians have fallen, in reference to the conduction of frictional electricity, in consequence of their not having distinguished its static from its current condition. Though in its static state, exhibited in induction, electricity is confined to the external surfaces, yet during conduction through metallic bodies it passes through the substance, and not along the surface alone, as is frequently erroneously stated. The four lectures are carefully reported in the *Morning Chronicle.*

TYER'S MAGNETO-ELECTRIC RAILWAY SIGNALS.

MR. TYER proposes, by the agency of voltaic electricity, to accomplish the following objects:—1. That the train itself, upon entering any station, shall give notice to the station it last left that the line is so far clear; 2, that, upon quitting a station, the train shall transmit a signal to the next station in advance, directing attention thereto by sounding a bell; 3, the transmission of signals from any intermediate point between stations, so that an alarm can be given, and assistance obtained, in the event of a break down, or other stoppage of the line; 4, that the engineman may be signalled from the station he is approaching at any distance deemed requisite, auxiliary signals and fog detonators being thus rendered unnecessary. The inventor proposes to arrest the attention of the driver by causing his apparatus to sound the steam-whistle; and his plan of signals includes a self-acting register, kept at each station, of the exact signals received. He believes that his invention would be found valuable not only at stations, but also at junctions, tunnels, level crossings, watchmen's boxes, in shunting trains, and in other emergencies. These various objects are mainly accomplished by the introduction of two contrivances—the one for establishing communication from the train to the stations on either side of it, the other for signalling from the station to the driver of an approaching train. The first contrivance consists of a treddle spring, which, pressed by the flanges of the carriage wheels in their passage over it, and establishing thereby an intermittent circuit of electricity through the wire extending to the station, sounds a bell and moves an index on a dial plate there, so as to give the required signal both to the eye and the ear. The second contrivance is a pair of brass plates, forming double inclined planes, about six feet long, and fixed upon the rails, so that metal springs beneath the frame of the engine come in contact with them, when the voltaic circuit is again completed, and signals at once indicated to the driver by an index on his locomotive, by the sounding of his whistle, or even by cutting off steam. The whole apparatus can be applied at any required points between stations.—*Times.*

Chemical Science.

ON OXYGEN.

PROFESSOR FARADAY has read to the Royal Institution a paper entitled, "MM. Boussingault, Frémy, Becquerel, &c., on Oxygen." The object was to bring before the members, in the first place, M. Boussingault's endeavours to procure pure oxygen from the atmosphere in large quantities; so that being stored up in gasometers it might afterwards be applied to the many practical and useful purposes which suggest themselves at once, or which may hereafter be developed. The principle of the process is to heat baryta in close vessels, and peroxidize it by the passage of a current of air; and afterwards by the application of the same heat, and a current of steam (with the same vessels), to evolve the extra portion of oxygen, and receive it in fitly adjusted gasometers; then the hydrated baryta so produced is dehydrated by a current of air passed over it at a somewhat higher temperature, and finally oxidized to excess by the continuance of the current and a lower temperature: and thus the process recurs again and again. The causes of failure in the progress of the investigation were described, as detailed by M. Boussingault; the peculiar action of water illustrated; the reason why a mixture of baryta and lime, rather than pure baryta, should be used, was given; and the various other points in the "Mémoire" of M. Boussingault noticed in turn. That philosopher now prepares the oxygen for his laboratory use by the baryta process.

The next subject consisted of the recent researches of MM. Frémy and E. Becquerel "On the Influence of the Electric Spark in converting pure dry Oxygen into Ozone." The electric discharge from different sources produces this effect, but the high intensity spark of the electric machine is that best fitted for the purpose. When the spark contains the same electricity, its effect is proportionate to its length; for at two places of discharge in the same circuit, but with intervals of 1 and 2, the effect in producing ozone is as 1 and 2 also. A spark can act by induction; for when it passes on the outside a glass tube containing within dry oxygen, and hermetically sealed, the oxygen is partly converted into ozone. Using tubes of oxygen which either stood over a solution of iodide of potassium, or, being hermetically sealed, contained the metal silver, the oxygen converted into ozone was absorbed; and the conversion of the whole of a given quantity of oxygen into ozone could be thus established: The effect for each spark is but small: 500,000 discharges were required to convert the oxygen in a tube about 7 inches long and 0·2 in diameter into ozone. For the details of this research, see the *Annales de Chimie*, 1852, xxxv. 62.

Mr. Faraday then referred briefly to the recent views of Schönbein respecting the probable existence of part of the oxygen in oxy-compounds in the ozone state. Thus, of the peroxide of iron, the third oxygen is considered by him as existing in the state of ozone; and of

the oxygen in pernitrous acid, half, or the two latter proportions added when the red gas, if formed from oxygen and nitrous gas, are supposed to be in the same state. Hence the peculiar chemical action of these bodies; which seems not to be accounted for by the idea of a bare adhesion of the last oxygen, inasmuch as a red heat cannot separate the third oxygen from the peroxide of iron; and hence also, according to M. Schönbein, certain effects of change of colour by heat, and certain other actions connected with magnetism, &c.—*Literary Gazette*, No. 1904.

ESTIMATE OF NITROGEN.

DR. SIMPSON, of Dublin, has described to the Chemical Society, a New Process for Estimating Nitrogen. There are two modifications of his method. The first serves for determining the comparative amount of nitrogen and carbonic acid formed during the combustion of an azotised organic substance. It does not differ widely from Liebig's process now in use, except that oxide of mercury, diluted with oxide of copper, is employed for burning the substance, and chlorate of potash is placed at the end of the tube to yield a supply of oxygen. The absolute method resembles Dumas's in principle—carbonate of manganese, however, being the substance employed for the production of carbonic acid; and some peculiar arrangements being introduced, especially in the receiver over the mercury trough. These processes have been worked out in Bunsen's laboratory; and are equally applicable to the determination of nitrogen in such substances as the vegeto-alkaloids, in nitrates, or in salts of ammonia.

OZONE.

THIS remarkable substance, which is sometimes, but not universally present in the atmosphere, and which has hitherto been regarded, when observed, to be an allotropic condition of oxygen, has been discovered, by a German chemist at Bonn, not to be so; but a distinct substance, existing as a teroxide of hydrogen, thus continuing the series of the compounds of oxygen with hydrogen.—*Medical Circular.*

OZONOMETER.

DR. JOHN DREW, of Southampton, thus describes Dr. Schönbein's method of ascertaining the amount of ozone in the atmosphere. The Ozonometer consists of twelve bundles of paper, prepared with iodine and starch; each bundle contains sixty strips, and serves for one month's observations; a spare set is added for additional observations during thunder storms, or whenever the air may appear to be overcharged with electricity. At nine o'clock every morning, a strip of the prepared paper is to be suspended in a spot to which the air has free access, but not the sun. It must be removed from dung-heaps, stables, &c., where gases are developed which would vitiate the observation. At nine o'clock in the evening the exposed strip is dipped in water. It will be found to assume a purple tint. The depth of this tint is compared with the corresponding colour on a

scale, on which there are ten gradations, and the number is to be inserted in the register with which it agrees in depth. Another slip of paper must be exposed at nine P.M., and examined and registered in a like manner, at nine A.M. on the following morning. At the close of each month, the mean is to be deduced, by dividing the sum of the numbers registered by the number of observations.

GAS MANUFACTURE.

MR. J. M. SOUCHON, of Paris, has patented a mode of increasing the quantity of Gas, and obtaining cyanides by passing the products of the distillation of coal, &c. through a heated retort containing alkali, or alkaline salts; for obtaining illuminative gas and cyanides, by injecting a mixture of tar and ammoniacal liquor into a heated retort, and passing the vapours through a second heated retort, containing alkali or alkaline salts; purifying gas by a series of revolving purifiers, containing liquids and pieces of wood, or other solid substances, continually wetted by the solutions, and exposed to the gas; and for a peculiar mode of constructing the doors of retorts and their hinges.

MORPHIA AND CODEINE.

DR. HOW, of Glasgow, has communicated to the British Association the results of an investigation designed to show that Morphia and Codeine, when acted upon by iodide of ethyl or methyl, yield substances analogous to the ethylamine, and similar compound ammonias, which have recently so much attracted the attention of chemists. The methyl compound derived from morphia is isomeric with the vegeto-alkali codeina, but different in properties.

EARLY EGYPTIAN CHEMISTRY.

IN the *Year-Book of Facts*, 1853, page 161, was given an abstract of Mr. Herapath's discovery of characters in "Marking-ink" upon the bandage of an Egyptian mummy. To this view Mr. Denham Smith objected, inasmuch, he said, as there was no evidence to prove the Egyptians were even acquainted with the art of distillation. Mr. Thornton Herapath next examined, with a microscope, the stained fibres of the bandage; and on making comparative experiments with a piece of the linen wrapper recently "marked" in the usual way with a solution of nitrate of silver, the fibres presented a very similar appearance to that of the ancient stained cloth. Hence Mr. Thornton Herapath concludes that the Egyptians were really acquainted with nitric acid, and employed the nitrate of silver as a marking fluid. In this view, Dr. W. Camps has also coincided, in a paper read to the Syro-Egyptian Society; "if," adds the doctor, "this were admitted, we must then allow the Egyptians to have had a more intimate acquaintance with chemistry and chemical preparations than is generally assigned even to these very clever, intelligent, and ancient people."

ON EVAPORATION.

Professor Marcet, of Geneva, has instituted a series of experiments with the view of throwing some light on the tendency of certain circumstances to promote or diminish the Evaporation of Liquids. The details are given in the *Philosophical Magazine*, No. 40.

The author concludes by remarking, that one of his results tends to confirm an opinion expressed some time since by Professor De la Rive, in a letter to M. Arago, published in the *Comptes Rendus de l'Académie des Sciences* for October, 1851. In this letter, M. De la Rive attributes the sudden appearance of vast glaciers in divers parts of Europe to a temporary refrigeration produced at the period of the elevation of the most recent European strata, by the evaporation of the water with which they were previously covered. If, as the author's experiments tend to show, evaporation takes place more rapidly from water mixed with sand, earth, or any similar substance, than from a surface of clear water, it becomes natural to conclude, that the cold produced by evaporation from the recently elevated and still humid strata, must have been greater than that resulting from the evaporation of the sea or freshwater lake which covered them previously to a great depth.—*Bibliothèque Universelle.*

SPONTANEOUS COMBUSTION.

In making the excavation for the lock on the Hove Ship Canal, near Brighton, a quantity of shale, of a blackish colour, which had been recently thrown out, spontaneously ignited. The stratum of shale is about 8 feet in thickness; the quantity thrown out was therefore large; and the whole of it, extending over a space of some score of square yards, gave signs of approaching combustion, while in many parts it was already burning like a limekiln. The process of combustion gave out a stifling and offensive vapour, and left upon the surface a deposit of a white colour, and also of a yellow substance; the former resembling saltpetre in appearance and taste, and the latter sulphur.

SPONTANEOUS DECOMPOSITION OF XYLOIDINE.

Dr. Gladstone has described to the British Association the changes that had taken place in a specimen of Xyloidine, made by treating arrowroot with nitric acid of specific gravity 1·5. After remaining about six years unaltered, this specimen suddenly began to give gases; and in a few weeks time nothing remained of the original xyloidine, but, in its place, a light brown viscid liquid.

DISCOVERIES IN GALVANISM.

The Rev. Nicholas Callan, of Maynooth College, has discovered a new apparatus for safely employing the mixed gases to produce the oxhydrogen flame and lime light: a new Voltameter, to which a common jet may be screwed, and the mixed gases inflamed as they issue from it, without the smallest risk of a dangerous explosion, and by which the full decomposing effect of a hundred or any number of

cells, arranged in one series, may be produced, without exhausting the power of the battery more rapidly than if it only contained four cells. The voltameter is new in every respect: the material of the decomposing vessel is wrought iron, an inch thick, coated inside with an alloy of lead and tin, or of lead, tin, and antimony. The decomposing plates are connected with the opposite ends of the battery, while the vessel remains air-tight; and a new arrangement is made in the fluid, through which the voltaic current is made to pass, in order to produce the mixed gases. By means of a small galvanic battery a brilliant intermittent lime light, which would answer for light-houses, can be produced. The lime light has been known to be seen 70 miles distance; and this invention, important as it is to light-houses, is easily managed, and need only be used in foggy weather and snowstorms. By means of a cast-iron battery of four cells, and as many zinc plates, each 6 in. by 8 in., and a small apparatus, a lime light of about $\frac{7}{8}$ in. in diameter may be produced for five seconds in every minute, or ten seconds in every two minutes. Mr. Callan states that at Maynooth College there is the best galvanic apparatus in Europe; comprising as it does a powerful battery, and the best means of exhibiting its heating, illuminating, decomposing, and magnetic powers.

NEW GALVANIC BATTERIES, INVENTED BY MR. KUKLA, OF VIENNA.

THE combination used in one of these Batteries is antimony, or some of its alloys, for a negative plate, with nitric acid of specific gravity 1·4, in contact with it, and unamalgamated zinc, for a positive plate, with a saturated solution of common salt in contact with it. A small quantity of finely powdered per-oxide of manganese is put into the nitric acid, which is said to increase the constancy of the battery. The alloys of antimony which Mr. Kukla has experimented with successfully are the following:—Phosphorus and antimony, chromium and antimony, arsenic and antimony, boron and antimony. These are in the order of their negative character, phosphorus and antimony being the most negative. Antimony itself is less negative than any of these alloys. The alloys are made in the proportions of the atomic weights of the substances. All these arrangements are said by Mr. Kukla to be more powerful than when platinum or carbon is substituted for antimony or its alloys. In this battery a gutta-percha bell-cover is used over the antimony, and resting on a flat ring floating on the top of the zinc solution,—which effectually prevents any smell, and keeps the per-oxide of nitrogen in contact with the nitric acid solution. When a battery of twenty-four cells was used, Mr. Kukla found that in the third and twenty-first cells pure ammonia in solution was the ultimate result of the action of the battery; but only water in all the others. This experiment was made repeatedly, and always with the same result. A battery was put into action for twenty-four hours,—at the end of that time the nitric acid had lost thirteen-twentieths of an ounce of oxygen, and one-quarter of an ounce of zinc was consumed. Now as one-quarter

of an ounce of zinc requires only 0·06 of an ounce of oxygen to form oxide of zinc, Mr. Kukla draws the conclusion, that the rest of the oxygen is converted directly into electricity; and this view, he says, is confirmed by the large amount of electricity given out by the battery in proportion to the zinc consumed in a given time. For this battery Mr. Kukla much prefers porous cells, or diaphragms of biscuit ware, as less liable to break, and being more homogeneous in their material, than any other kind. This battery is very cheap, antimony being only *5d.* per lb., wholesale, and the zinc not requiring amalgamation.

The second arrangement tried by Mr. Kukla was antimony and amalgamated zinc with only one exciting solution, viz., concentrated sulphuric acid:—this battery has great heating power, and the former great magnetizing power:—it, however, rapidly decreases in power, and is not so practically useful as the double fluid battery, which will exert about the same power for fourteen days, when the poles are only occasionally connected as in electric telegraphs. Certain peculiarities respecting the ratio of intensity to quantity when a series of cells is used, have been observed, which differ from those remarked in other batteries.

Mr. Kukla, on directing his attention to the best means of making a small portable battery for physiological purposes, has found very small and flat Cruikshank batteries, excited by weak phosphoric acid (one of glacial phosphoric acid to twenty of water), to be the best. Phosphoric acid being very deliquescent, and forming with the zinc, during the galvanic action, an acid phosphate of zinc. A battery of this description does not decrease in power very materially until it has been three hours in action.—*Proceedings of the British Association: Athenæum,* No. 1351.

STRINGFELLOW'S GALVANIC BATTERY.

THIS arrangement is stated in the *Association Medical Journal* to be the most perfect for physiological purposes which has ever been contrived. In size it does not exceed a lady's card-case. Its principle is the same as Pulvermacher's chain; but it is more effective and energetic, on account of,

First. The very small obstruction offered to the passage of the current, from the perfect connexion of the metallic element, instead of their being hung on loops.

Second. The large extent of the generating or electro-positive element, and its very close proximity to the conducting or electro-negative element; thus reducing to a minimum the opposition offered to the current flowing through the exciting fluid.

Third. The extreme compactness of the apparatus; twenty-two compound elements entering, after being excited, into a common card-case, and evolving a current capable of decomposing water, and giving smart shocks for nearly half an hour; evaporation being prevented by the ingenious plan of inclosing the battery in a card-case.

The remarkable fact connected with this battery, of four elements, *moistened with water only,* being capable of decomposing distilled water, is worth attention, and can only be explained by the almost complete absence of all opposing causes interfering with the passage

of the current; hence, *all the electricity excited is thrown into current, and none lost;* whereas, in some pieces of apparatus of this kind, a great quantity is lost. This new battery is described and illustrated in the *Mechanics' Magazine*, No. 1556. It is manufactured very neatly, by Mr. Stringfellow, at Chard, Somersetshire; and sold in great numbers by the Messrs. Elliot, opticians, West Strand.

HARDENING OF ENGLISH CAST STEEL FOR CUTLERY.

August Kieser, of Issny, in Switzerland, prepares some admirably hardened razors, pen-knives, &c., from English cast steel, by immersing the blades at a dark cherry-red heat into a bath composed of—4 parts of finely-powdered yellow rosin, 2 parts of fish-oil, to which is added, in a very hot state, 1 part of melted tallow, and allowing them to cool perfectly; after which they are heated without wiping them, and hardened in water in the ordinary way. The blades hardened by this process are found to be more uniformly done than by any other method; at the same time that they are not too much so, or the metal too brittle; the edge is exceedingly fine.—*Gewerbeblatt aus Württemberg*, No. 15.

LOSS OF SULPHUR IN SMELTING ORES.

The *Cornwall Gazette*, after describing Mr. Andrew Crosse's patent for extracting metals from their ores by electricity, alludes to the great advantages which would ensue nationally were measures adopted for securing the sulphur contained in a majority of the copper ores, now dissipated in the atmosphere by the present mode of roasting the ores for smelting. The principal portion of the copper ores of Cornwall are pyrites, containing in addition to the copper and earthy matters, a considerable portion of iron and a large amount of sulphur. The iron is comparatively of little value, and would not pay for recovering; but taking the copper pyrites at 12,000 tons per month, probably near the average, 18,000 tons of sulphur are wasted per annum, which, by proper chemically scientific principles, might be saved, increase the mineral wealth of the counties of Cornwall and Devon by £150,000 a-year, render us to a certain extent independent of Sicily, and the copper smelting works cease to be the destructive nuisances which they are at present.—*Mining Journal.*

PERMEABILITY OF METALS BY MERCURY.

M. J. Nickles, in experimenting on the metals, has discovered that those which will form an amalgam with mercury are easily permeated by it. Horsford and others establish the permeability of tin, lead, gold, silver, zinc, and cadmium, to which M. Nickles adds copper and brass. This fact was discovered by accident—he was using a Bunsen's battery; the connecting pieces of copper were riveted to the zinc, and on amalgamating the latter metal, it often happened that the mercury spread itself over the copper, and after a certain time this latter metal became brittle, having a white fracture, proving itself an amalgam. With a stylet, he then traced a furrow

on plates to be experimented on, and placed a little mercury therein. In order to hasten the amalgamation, a drop of bi-chloride of mercury, acidified with hydro-chloric acid, is introduced. By this means the amalgamation takes place instantly, and the surface is fitted to retain at once the quantity of mercury necessary to produce the effect.

DEODORIZING PROPERTIES OF COFFEE.

THE *London Medical Gazette* gives the result of numerous experiments with roasted coffee, proving that it is the most powerful means, not only of rendering animal and vegetable effluvia innocuous, but of actually destroying them. A room in which meat in an advanced degree of decomposition had been kept for some time, was instantly deprived of all smell, on an open coffee roaster being carried through it containing a pound of coffee newly roasted. In another room exposed to the effluvium occasioned by the clearing out of a cesspool, so that sulphuretted hydrogen and ammonia in great quantities could be chemically detected, the stench was completely removed within half a minute, on the employment of three ounces of fresh roasted coffee; whilst the other parts of the house were permanently cleared of the same smell by being simply traversed with the coffee roaster, although the cleansing of the cesspool continued several hours after.

The best mode of using the coffee as a disinfectant is to dry the raw bean, pound it in a mortar, and then roast the powder on a moderately heated iron plate until it assumes a dark brown tint, when it is fit for use. Then sprinkle it in sinks or cesspools, or lay it on a plate in the room which you wish to have purified. Coffee acid or coffee oil acts more readily in minute quantities.

FIRES EXTINGUISHED BY STEAM.

THE process proposed by M. Dujardin, of Lille, has been tried with full success during a fire that occurred lately in the galvano-plastic workshops of MM. Christoffe, at Paris. The flames had already made great progress, and threatened the entire destruction of the building, before aid could be had. At this crisis, some one present suggested the opening of the valve of the boiler which feeds the engine, when the steam immediately penetrated through the workshops. The fire was seen to diminish, and soon was so reduced, that it was easily mastered, when aid arrived.—*American Journal of Science and Arts.*

PURIFICATION OF GRAPHITE.

RUNGE proposes to purify poor Graphite for pencils by digesting for 36 hours the finely powdered mineral with about double its weight of concentrated sulphuric acid; then diluting the acid with water, and washing the powder free from acid. Graphite thus powdered, is very much cheaper than the ordinary English, and is quite as pure as the best Borrowdale black-lead. The decanted sulphuric acid contains iron, sulphate of alumina, &c.; the latter

may be separated when large quantities of graphite are operated upon. Runge also proposes to add a little lamp-black with the graphite, in order that the lines made by the pencils may have a deeper shade of black. Probably, certain kinds of manganese may be used for the same purpose.—*Le Technologiste,* April, 1853.

NEW PATENT MINT APPARATUS.

LAST autumn was shipped from London the apparatus for the Royal Mint about to be established at Sydney. The melting-pots, crucibles, and other requisites for converting the dust into coin were supplied by Messrs. Morgan and Rees; and are the new kind, known in the trade as their "Patent Plumbago" and "Fluxing Pots," which had been selected on account of their superior safety and durability.

We understand the experience of the last twelve months at the principal refining establishments (amongst which are included that of the Bank of England, and the French Mint) has proved the "Plumbago" to be six times more durable than the "Black Lead" kind hitherto employed, and much less liable to accidents.

CORROSION OF IRON.

DR. GLADSTONE has read to the British Association, a paper "On the Corrosion of Iron Ships by Sugar Cargoes;" showing the readiness with which sugar attacks the solid metal, dissolving it as the protoxide, from which, through the concurrent action of the air, the red oxide is deposited. He narrated experiments made on other metals, which proved that sugar attacked most of them, though not so much as iron, while it left the oxide untouched. An animated conversation arose among the audience as to the bearing of this on the use of iron ships for the transport of sugar, and it was concluded that the use of wooden planking, and paint made with red lead, would obviate the difficulty in a great measure.

TO PREVENT THE DECOMPOSITION OF URINE.

CHEVALIER proposes to collect the urine at railway stations, for agricultural purposes, in large cisterns; and to preserve it from decomposition by adding to each pound of urine some five or six drops of coal-tar or coal-tar oil. The employment of a little sulphate of iron, or caustic lime in water-closets, would be more effectual in checking the effluvia, than the present plan of throwing a jet of water over the trough.

LONDON WATER.

MR. MEDLOCK has read to the British Association, an account of analysis of waters from wells in and about London, which gave rise to a brisk conversation, partly chemical, partly geological. The most interesting fact elicited was, that the water which rises from the upper portion of the chalk, is similar in composition to that from the superincumbent beds of the tertiary strata, differing wholly from the proper chalk water. Mr. Ferguson then spoke of the great

increase of weight which takes place in casks of brown sugar or molasses by absorption of water from the atmosphere, amounting in one case to fifty-six hundred weight in a whole cargo.

CONDITIONING SILK.

MR. CHABOT has read to the Chemical Society, a paper detailing at considerable length the history and practice of "Conditioning" Silk. He stated that disputes used frequently to arise between the weaver and merchant, owing to the variations caused in the weight of silk by the hygrometric condition of the atmosphere, and other fortuitous circumstances—variations which often amounted to as much as three per cent. Public "conditioning houses," as they are termed, were therefore established at Lyons, and elsewhere on the continent, which serve as a place of appeal as to the exact amount of silk any sample contains, and which are constantly resorted to by dealers in the article. A similar house has recently been established in London. The process adopted is as follows:—From each bale twenty-four or more hanks are taken, these are again divided into three lots, and weighed very precisely. Each lot is then suspended at the end of a very delicate balance, in a copper cylinder heated to twenty or thirty degrees above the boiling point of water. After three hours, or thereabout, when the silk no longer changes in weight, it is weighed; and to this eleven per cent. is added, which is esteemed the standard proportion of water that absolutely dry silk ought to absorb. This increased weight is that at which the article is reckoned in the invoice. Mr. Chabot proceeded with a description of raw silk, showing how the natural oils and gummy matters are got rid of by boiling it with soap and water; except where the material is intended for the manufacture of crape, in which case the gum is allowed to remain in, or is even increased in quantity, so as to impart to the fabric the desired crispness. A number of details were then given, showing the differences of the hygrometric character of raw and thrown silk, and the paper concluded with a few remarks on the desiccation and humectation of wool. During the discussion that ensued, Mr. Thomas Taylor stated that the silk throwsters employ gummy matters, such as rice-paste, adding them to the natural silk; and as it is required of the dyer to return at least as great a weight of silk as he received, he makes up the amount of what is washed out of the material, by employing various matters, such as sugar, to the extent perhaps of 18 per cent., in addition to the actual colouring matter.

THE COCA LEAF.

PROFESSOR JOHNSTON, after describing to the British Association the remarkable physiological properties of the leaves of this plant, explained that they yield to ether a peculiar volatile resinous substance possessed of a powerful odour, in which the peculiar virtues of the leaf are supposed to reside. The plant is as yet to be obtained in too small quantities in this country to admit of a complete chemical examination of the substances which the leaves contain.

ECONOMY OF FLAX.

PROFESSOR HODGES has communicated to the British Association his "Report on the Gases evolved in Steeping Flax, and on the Composition and Economy of the Flax Plant." The investigations directed by the Association, at the Belfast Meeting, with respect to the gases evolved in the steeping of flax, and the composition of flax straw, are in progress, and will be reported at the next meeting. The gases of the fermenting vat have been analyzed by the methods of Professor Bunsen, and have been found to consist of carbonic acid, hydrogen, and nitrogen. No sulphuretted hydrogen has, in any case been detected. Several analyses of the proximate constituents of the dressed fibre and of its inorganic ingredients have been made, which show that a considerable amount of the nitrogenized and other constituents of the plant are retained in the fibre, even after steeping and dressing have removed the structures unsuitable for textile purposes.

DISEASES IN THE VEGETABLE KINGDOM.

DR. PRICE has read to the British Association two papers, which promise important results, in attacking Diseases incident to the Vegetable Kingdom. Dr. Price stated that some vines which he had washed with a solution of the higher sulphides of calcium had been cured of the grape disease, and had remained untouched for two years, while the surrounding vineries had all suffered. Chevalier Claussen had preserved potatoes which were slightly attacked with the disease, by steeping them first in a very weak solution of sulphuric acid, and afterwards in lime water. If these two processes are found generally successful, the one will be an inestimable boon to the inhabitants of France, Spain, and Portugal; the other to all those to whom the potato forms an important article of culture or food.

IODISED MANURES AS A REMEDY FOR THE VINE DISEASE.

IT is doubtless well known to most of our readers that the vineyards of Southern Europe and the Madeiras have been blighted by a microscopic acarus, the *Oidium Tuckeri*, and that the price of wines, raisins, &c., has been considerably raised. It has, however, been ascertained that the use of manures rich in iodine, enables the vine to resist these destroyers. In certain districts of Spain decomposed seaweeds are ordinarily used as manure. In those parts in which the amount of iodine in the soil may average 1-600,000, the vines have entirely escaped.—*The Artizan.*

ARTIFICIAL IVORY VENEERS.

J. MUNK, of Gaisberg, employs as a substitute for ivory and bone veneers, in inlaid work, Artificial Veneers made from goat and sheep's bones and fleshings of deer-skins, parchment parings, &c. The bones are first treated for ten or fourteen days with chloride of lime, and then washed with water, and dried. The prepared bones are then put with the fleshings and parchment parings into a copper,

and are dissolved by steam into a fluid mass. To each tenth of this is added one-fourth of a pound of alum; fire being at the same time made under the copper, that the alum may combine with the mass. As soon as the scum rises, it is taken off, until the mass looks clear and pure. Any desired colour is added while the mass is still warm; after which, it is strained through rough linen cloth, and poured into the mould, where it remains until it is cool enough to be turned out on cloths stretched upon frames, and left to dry in the air. When the plates are quite dry, they are steeped from eight to ten hours in a cold solution of alum, until they have acquired the requisite degree of hardness. For this steep, half a pound of alum is employed for every pound of veneer. When the artificial ivory is taken out of the alum solution, it is washed with clean, fresh water, and again dried upon the frames, when it may be considered finished.—*From the German,* translated in the *Journal of Industrial Progress,* No. 1.

PURIFICATION AND APPLICATION OF GLYCERINE.

SOLID fats and oils are composed of two principles, fatty acids and a sweet oily substance, termed Glycerine or fat-sugar. The process of making soap consists in boiling a fat with a ley of potash or soda, which unites with the fat acids and sets the glycerine free. In the manufacture of stearic acid for making stearine candles, by saponification with lime, a considerable quantity of glycerine is also produced. Until lately this substance formed the waste ley of the soap boiler, and was rejected as useless; or when purified, was merely employed in the researches of the chemist. Its first practical employment was in certain diseases of the ear; subsequently it was found to be very efficacious in the cure of cutaneous diseases, for which it is now largely employed. M. Bruére Perrin, of Rennes, has made several new applications of it: for example, he uses it for toilette soaps, which, though quite unctuous, do not grease the hands. He also prepares a cosmetic vinegar. M. Barreswil has used it with success for preserving clay in a sufficiently plastic state to model with.

NEW YELLOW VARIETY OF THE SUGAR BEET.

M. PERIER, manufacturer of sugar at Flavy-le-Myrtel, has sent to the Central Society of Agriculture of France, a small bag of the seed of a New Yellow Pear-shaped Variety of the Beet, with very slightly coloured flesh, and containing apparently more sugar, on an average of a great number, than any of the varieties hitherto known. The following is the result of Payen's analysis:—

Water	82·35
Pure sugar	11·45
Other organic substances	5·55
Alkaline salts	0·45
Earthy salts	0·20

NEW PROCESS FOR THE MANUFACTURE OF SPIRIT FROM BEET-ROOT.

MM. BAVELIER and Champonnois have invented a process which

fulfils these four conditions—1. The complete extraction of the juice; 2. Regularity and completeness of fermentation; 3. The distillation of a purer juice by cheap and effective means; and 4. The utilization of the residues. Their system of operations consists in slicing the roots, and extracting the juice by maceration, in washing out the soluble constituents of the beet with water, when the albumen is removed, and the whole of the soluble salts, so that nothing remains but the cellular matter of the beet, filled with nearly pure water. This residue would possess scarcely any value as food, and could indeed only be employed as manure. When beet juice is fermented the sugar is converted into alcohol, and may be obtained by distillation; and there remains behind certain of the valuable constituents of the beet, such as the salts, nothing indeed being lost but the sugar. If we could restore all these things back to the sliced roots, we would have everything, minus the sugar. Such is the principle of the new process.—*Annales de l'Agriculture Française.*

CHEAP BRONZE COLOURS.

Deuzer describes these colours to be well adapted for paper-stainers. If some alum be dissolved in a hot decoction of Brazil-wood, which had been previously allowed to clear itself, by resting for several days, a precipitate will form on the liquid cooling, which will gradually increase if it be set aside, and will contain nearly the whole colouring matter. If this precipitate be washed once with water, and rubbed thick on paper, it will dry with a beautiful brilliant golden hue, tending somewhat to green, which resembles the wing-cases of dried Spanish flies. If a little of this precipitate in the condition of a paste be mixed with size and some straining material (formed of wax dissolved in soap), and then rubbed with a brush upon paper, it may be polished with an agate or glass ball, upon which it will assume a beautiful yellow metallic lustre, very similar to bronze. To obtain this effect, however, it must be laid on sufficiently thick to be perfectly opaque. Similarly a bronze colour may be made from logwood; but the preparation is different, and the colour is more like that of copper, whilst the former approaches nearer to the colour of brass. If a fresh prepared decoction of logwood be heated in a copper pan, then precipitated with chloride of tin (tin salt), a rich dark brown precipitate will be obtained. This precipitate, washed and treated as the last, communicates to the paper a copper bronze. A darker shade may be obtained by adding to the hot decoction of logwood a little alum, and then decomposing it with a still smaller quantity of red chromate of potash.

TREMORLESS QUICKSILVER.

The Rev. Mr. Pritchard, F.R.S., has described to the Cambridge Philosophical Society a new process of rendering Quicksilver Tremorless for astronomical observation. He adopts a silver-plated or amalgamated copper vessel of a peculiar form, admitting the use of a very thin stratum of mercury, without the necessity of an inconvenient amount of shallowness in the vessel itself. Mercury, how-

ever, placed in an amalgamated vessel, after a short time becomes covered with a singular film of amalgam, which impairs the reflecting power of the surface; and if at all agitated, soon entirely destroys it. And this is the case even when the vessel is made of amalgamated platina. The most important and by far the most difficult part of Mr. Pritchard's experiments consists in the invention of a method by which these films can be easily and practically removed. The details are explained in a memoir read to the Astronomical Society of London; and the process has been adopted at the Royal Observatory at Greenwich, and tried at the observatories of Paris and Cambridge.

CHEMICAL ACTION OF LIGHT.

MR. ROBERT HUNT has read to the British Association a Report, in which he explained the three spectra—luminous, calorific, and actinic; and the means of cutting off certain rays by the use of coloured glasses. He had recently found that, contrary to previous experience, he could by certain arrangements obtain photographs by the chemical action of the yellow rays. He brought forward instances, too, of the protection of those parts of the sensitive plate which have been exposed to the influence of the red rays. An animated discussion ensued between the author of this Report and Professor Stokes, who, after describing five different actions of light—the luminous, calorific, chemical, phosphorescent, and fluorescent—expressed his own conviction that they arise from one and the same cause, acting differently—functions, as it were, of the same power. He stated that if it could be clearly established that one set of rays had been cut off entirely from the others, it would at once settle the question in Mr. Hunt's favour; but this had not yet been done.—*Literary Gazette*, No. 1914.

REPRODUCTION OF ENGRAVINGS AND DRAWINGS BY THE VAPOUR OF IODINE.

IN 1847, M. Niepce de St. Victor published a Memoir on the Action of Different Vapours, and amongst others that of Iodine, which, he stated, attached itself to the black portions of an engraving, to the exclusion of the white; so that the picture could be reproduced on paper sized with starch, or on glass coated with this substance: in this manner designs were produced, but they could not be rendered very permanent. M. Niepce de St. Victor now proposes to render them unalterable by the following processes:—If a design obtained on starched paper or glass, in the manner described by him in 1847, be plunged into a solution of nitrate of silver, it will disappear; if the paper or glass be then exposed to the light for a few seconds, the iodide of silver, into which the iodide of amidone which formed the primitive design has been converted, being much more sensitive than the nitrate of silver with which the rest of the surface is imbued, is acted upon much more rapidly; if the paper or glass be then dipped into a solution of gallic acid, the design is immediately reproduced, and it is then treated with hyposulphite exactly as is done with pho-

tographic pictures. By this process the design becomes as permanent as these latter, and it will probably be adopted in many cases.

M. Bayard has just made another application: after exposing the engraving to the vapour of iodine, he applies it upon a glass prepared with sensitive albumen, so as to form a negative picture, with which he then takes positive impressions on paper in the usual manner. In this manner he has obtained beautiful reproductions of very old engravings without any distortion of the image.—*Comptes Rendus: Philosophical Magazine*, No. 33.

ARTIFICIAL PRODUCTION OF DIAMOND POWDER.

SOME considerable sensation has been produced in the scientific circles of Paris, by the announcement of the Artificial Formation of Diamond Powder. M. Despretz has made two communications to the Paris Academy of Sciences, upon carbon. In these he states, that placing at one, the inferior, pole of a voltaic battery, a cylinder of pure charcoal (its purity being secured by preparing it from crystallized white sugar-candy), and at the superior pole a bundle of fine platinum wires, so arranged that the charcoal was in the red portion of the electric arc, and the platinum in the violet; he found the carbon volatilized, and collected on the platinum wires in a changed state. In these experiments, the current has been continued during a month in activity, and the powder collected on the wires has been found to be sufficiently hard to polish rubies with great rapidity, and when burnt, it left no residue. M. Despretz asks himself, Have I obtained crystals of carbon which I can separate and weigh, in which I can determine the index of refraction and the angle of polarization without doubt? No. I have simply produced by the electric arc, and by weak voltaic currents, carbon crystallized in black octohedrons, in colourless and translucent octohedrons, in plates also colourless and translucent, which possess the hardness of the powder of the diamond, and which disappear in combustion without any sensible residue. A similar result has been obtained by decomposing a mixture of chloride of carbon and alcohol, by weak galvanic currents. The black powder deposited was found to possess equal hardness with that which was sublimed, and rubies were readily polished by it. A few years since, graphite and coke were formed from diamonds. We now appear to be advancing towards the conversion of graphite and coke into diamonds.—*Athenæum*, No. 1355.

ON THE CAUSES WHICH RENDER BREAD STALE.

IT has been generally considered that fresh bread loses water when passing into the stale state, and that this is the sole cause of the metamorphosis. Boussingault shows that this change is effected even when the bread is kept in a damp cellar, the hardest and most brittle crust becoming tough and flexible. A loaf kept in a warm, dry room for six days, at the end of which time it was perfectly stale, had lost only 0.01 per cent., from which it is quite clear that the staleness could not have arisen from a loss of water. By

heating it for some time up to 158° Fahrenheit, it became quite fresh, having lost 3¼ per cent. of water. Various other experiments were instituted, which showed the same result; in a tin plate cylinder closed with a stopper, the author completely restored stale bread to the fresh state in the course of an hour, by a temperature of 122°—140° Fahrenheit, produced by a water bath. The staleness of bread results, therefore, from a change in its molecular condition, altered by the application of heat, and not from a loss of water.—*Comptes Rendus.*

PHOTOGRAPHY.

MR. R. HUNT has read to the British Association a popular exposition of the various processes of Photography, illustrated by a number of very beautiful specimens, which greatly interested the audience. He described the influence of the solar rays on different sensitive preparations; explained the chromatype, cyanotype, and chrysotype; and passing on to the salts of silver, he spoke in detail of all the processes of the calotype; of the methods of taking pictures on albuminized glass, on waxed paper, and on collodion. After this M. Claudet explained the whole process of the Daguerréotype, while taking a view of the assembled audience. The subject was again very fully entered upon, by Professor Hunt, in a lecture, when he explained a number of curious phenomena connected with light; illustrating them by numerous pictures, some of which, taken in a lunatic asylum, had been produced so instantaneously, as to exhibit the transient features of insanity.

PROGRESS OF PHOTOGRAPHY.

PHOTOGRAPHY has been in great practical activity throughout the past year; the following are records of the leading novelties.

The Photographic Institution has been opened in New Bond-street, by that tasteful and skilful artist, M. Philip Delamotte, and presents a marked advance upon the late Exhibition by the Society of Arts. M. Delamotte's collection consists of some two hundred and fifty framed examples, and the contents of three portfolios. The principal contributors are M. Delamotte himself, M. Bresolin, R. Helle, F. Martens, H. Le Secq, and R. J. Bingham. Among the specimens were several remarkably fine views of the Crystal Palace at Sydenham. The finest portrait taken by M. Delamotte that we remember to have seen is a *vera effigies* of Mr. Peter Cunningham, F.S.A.

The Photographic Society has commenced its operations with considerable vigour. Sir William Newton has read a paper on Photography in its relations to art, in which he dwelt largely on the suggestive character of the photographic picture to the educated artist. At the same time he guarded the young student against the use of the camera during his early studies, from its tendency to lead to mere mechanism in securing the beautiful details of the photographic picture; and consequently to an absence of that mental power by which every line should be determined and every colour arranged. Dr. Percy made a communication on the use of wax paper in warm weather, which contained some important suggestions. On the second evening, Mr. Robert Hunt read a paper on the construction of photographic lenses, which gave rise to a very animated discussion. This was followed by a communication from Count Montizon on the collodion process; illustrated by some beautiful collodion pictures of the quadrupeds and birds in the Zoological Gardens, which show in a remarkable manner the extreme sensibility of the process employed. The third evening was devoted to the consideration of

the construction of the Photographic Camera Obscura. A great number of instruments were exhibited, many of them exhibiting much ingenuity. The Journal of the Society affords much valuable information to those interested in the advance of Photography.

Exhibition of Photographs by the Society of Arts.—Mr. Glaisher, the writer of the very able Jury Report on the Photographs in the Great Exhibition, has critically examined the collection exhibited in the rooms of the Society of Arts, and has reported thereon with great care, and so elaborately that even an abstract is beyond our power. It would, indeed, be of little comparative value without the pictures to refer to, in illustration and proof. Mr. Glaisher came to these general conclusions:—"Whether Photography will ever exist as an independent art, without assistance borrowed from the artist, is a matter of pure speculation. At the present time there is much to be done before this most graphic process can approach within even near limits to the beautiful semblance of Nature we find preserved in the works of our best artists. It is necessary that the photographer should receive a better artistic education; that he should be better acquainted with those laws belonging to science by which the canvas is made to assume the semblance of some of Nature's most agreeable effects: it is necessary that he should know how to choose his point of view; to decide upon the proper balance of light and shade; to have a correct appreciation of the strength of outline and development of parts belonging to the distances of his picture; that he shall not resort to violent contrasts for effect, and that he shall choose the tone most in accordance with his subject. The true knowledge of these, among other things, must belong to the photographer who would step beyond the level of ordinary practice. To the artistic spirit infused into the Photographic Society, so newly organized, we must look for his better guidance to those points of study; but with all its imperfections, Photography may be considered as sufficiently under control to be rendered a subsidiary and highly useful art."

Bank Notes and Photography.—In October last there appeared in the London newspapers certain paragraphs stating that fraud had been practised on the Bank of England by counterfeit notes, produced by the agency of Photography. This announcement called forth a long letter in the *Times*, from M. Claudet, proposing, as a security against the forgery, the production of bank-notes, on the usual white paper, with a tasteful design in a variety of colours. The alarm, however, proved a false one; for no attempt at the forgery had been made. The difficulty, indeed, the impossibility, of producing fac-simile Bank of England notes by any photographic process which would escape detection, has been well pointed out in a letter to the *Times*, by Mr. E. G. Wood, one of the members of the Photogrpahic Society. He says:

"The alarm that may be excited by such a paragraph would be quite unfounded, for the detection of the fraudulent note is very easy.

"The water-mark of the bank-note results from a difference in the substance of the paper, and is only visible by transmitted light; that is, when the note is held up so that the light may pass through it, it being in the body of the paper.

"Now, the imitated watermark would be on the surface only, and it would be produced by a slight darkening of the front of the note, corresponding exactly with the thicker portions of the paper of the note it was copied from; and would, therefore, be visible by reflected light as well as by transmitted light, and would be on the front only, and not on the back as well; consequently, by doubling a note so produced, so as to see at the same time part of the back and part of the front, the fraud would be at once detected, as the watermark would not be on both."

Collodion Process.—Mr. John Stewart, of Rome, has communicated to his brother-in-law, Sir John F. W. Herschel, an ingenious method, in part discovered by M. Heilmann, of taking from glass negative—positive impressions of different dimensions, and with all the delicate minuteness which the negative may possess. The plan is as follows:—the negative to be reproduced is placed in a slider at one end of a camera or other box, constructed to exclude the light throughout. The surface prepared for the reception of the positive—whether albumen, collodion, or paper—is placed in another slider, as usual, at the other extremity of the box, and intermediately between the two extremities is placed a lens. The negative is presented to the light of the sky, care being taken that no rays enter the box but those traversing the partly transparent negative. These rays are received and

directed by the lens upon the sensitive surface, and the impression of the negative is there produced with a rapidity proportioned to the light admitted, and the sensibility of the surface presented. By varying the distances, any dimension required may be given to the positive impression. Thus, from a medium-sized negative, have been obtained negatives four times larger than the original; and other impressions reduced thirty times, capable of figuring on a watch-glass, brooch, or ring. Upon the advantages of the microscopic minuteness of this process, Sir John Herschel observes, the *publication* of concentrated microscropic editions of works of reference, maps, atlases, logarithmic tables, or the concentration for pocket use of private notes and MSS., &c. &c., and innumerable other similar applications—is brought within the reach of any one who possesses a small achromatic object glass of an inch or an inch and a-half in diameter, and a brass tube, with slides before and behind the lens of a fitting diameter to receive the plate or plates to be operated upon,—central or nearly central rays only being required.—See Mr. Stewart's letter in *The Athenæum*, No. 1341.

Colouring Photography.—M. Tardien, of Rennes, has patented a process, called "Tourderochromy," which is applicable only to such photographic pictures as are taken on transparent paper, or on glass, or other transparent material. It consists in applying oil or other colours at the back of the picture, so as to give the requisite tints to the several parts of the photograph.

Crayon Daguerréotypes.—M. Mayall has invented an apparatus by which he produces an effect of arrangement similar to that of a crayon portrait. By its means a more truthful gradation is obtained, and the force in the features of the face is freed from that exaggeration hitherto inseparable from the process; the tint being harmonious and neutral.—the various textures of flesh, hair, drapery, discriminated with a painter's taste. The mechanical arrangement of this invention consists of a slowly-revolving disc, arranged on a support like a fire-screen, and having a central opening in the form of a large star. This disc is carried between the forks of a framepiece, the stem of which is adjustable as to height in the pedestal. To keep the disc in motion, an arrangement of clockwork is attached to the framing,—the actuating spring being contained in a box, driving a spur-wheel and gear with a pinion on the spindle of the fly. The screw for setting the disc up or down is at a certain point. This apparatus is interposed between the object, or sitter, and the camera; and the central portion of the star is made large enough to admit the rays from that part of the object which is to be shown in strong light, whilst the rays from those parts which are to be gradually shaded off to a dark background are partially intercepted by the points of the star. In this way the intensity of the light is gradually destroyed, and the softened-off "crayon" effect is produced. The apparatus is applicable to every description of camera,—and by placing it nearer to or further from the lens, any portions of the image may be so softened off.

Engraving on Steel.—A discussion has taken place at the Paris Academy of Sciences, between MM. Arago, Biot, and Chevreul, as to the respective rights of Mr. Talbot, of London, and M. Niepce de St. Victor, as to the invention of Photographic Engraving on plates of Steel. The processes of these chemists are different. Mr. Talbot uses, for the substance impressible to light, a mixture of gelatine and bichromate of potash, which is modified and browned on the immediate contact of light, and only where the light acts, whilst the part covered by the object to be copied remains untouched, and may always be removed by water. M. Niepce has aimed to perfect the process which his uncle, the inventor of heliography, described in the year 1827. The sensitive substance is a solution of bitumen in essence of lavender, applied in a layer; this varnish changes its properties while under the action of light. The parts exposed to the sun become insoluble in a mixture of essence of lavender and oil of petroleum, so that they may be easily separated from the soluble part not impressed, which represents the image to be reproduced. The liquid employed by Mr. Talbot for biting in on steel after his design, is bichloride of platinum; and that of M. Niepce, a mixture made of one part of nitric acid, eight parts of distilled water, and two of alcohol. We mention only these general facts, the details belonging more especially to the domain of technology upon steel. The particulars are, however, too lengthy for quotation. They will be found in Nos. 1328 and 1331 of the *Athenæum.*

Measuring the Sun's Light.—It is well known that the paper prepared for

photography grows more or less black by rays of light falling on it. M. Schall, of Berlin, has taken advantage of this property in photographic paper to determine the intensity of the sun's light. After more than 1500 experiments, M. Schall has succeeded in establishing a scale of all the shades of black which the action of the solar light produces on the photographic paper—so that, by comparing the shade obtained at any given moment on a certain paper with that indicated on the scale, the exact force of the sun's light may be ascertained. Baron Alexander von Humboldt, M. de Littrow, and M. Dove, have congratulated M. Schall on this invention, which will be of the highest utility, not only for scientific labours, but also in many operations of domestic and rural economy.

Photographic Paper.—Dr. Mansel, of Guernsey, has communicated to the *Athenæum* an ingenious method of preparing Iodised Paper. Instead of using the air-pump for freeing the paper from particles of air, the Doctor, having cut the paper somewhat larger than the picture, folds up the margin all round, so as to form a shallow paper-pan: this is placed on a clean piece of plate glass; pour into it freely the usual solution of iodide of silver in hydriodate of potass, and by a few rapid movements of "va-et-vient," the paper in a second or two is completely flooded: continue to wave the fluid over the paper until it acquires a violet tint; the excess of iodide is now poured off, and the paper pinned up to dry. As soon as it is dry, wash it in many waters, making a point of not continuing this washing for more than ten or fifteen minutes. In this way you get a paper thoroughly and most evenly impregnated with a thick body of iodide of silver, insuring a fine uniform tone to the negatives.

Rice Paper Photographs.—A Correspondent of the *Mechanics' Magazine* has used for camera operations, Rice Paper from India, China, &c.: its characteristic cellular structure affording the advantage of obtaining a photograph possessing qualities of softness and depth of tone not obtainable on ordinary paper. The most convenient method of applying the solutions appears to be that of saturation —one surface being finally brought into contact with the sensitive reagent, as in the calotype, &c. When the Rice-paper has received the preliminary treatment, it should be dried under gentle pressure, to preserve its flatness, until the period of exposure. It is best kept in contact with the camera-tablet by means of an interposed film of fluid.

Stereoscope Application.—M. Claudet has described to the Society of Arts, his Stereoscope, by which he has illustrated various curious phenomena of vision; adding that Sir David Brewster, in a paper read before the British Association in 1849, on various phenomena of binocular vision, brought forward a Stereoscope based on the principle of the refracting Stereoscope of Prof. Wheatstone, particularly adapted to the inspection of Daguerréotype pictures, and formed of two semilenses, which Sir David Brewster called the Lenticular Stereoscope. Some time after, Sir David, being in Paris, had occasion to give the description of this instrument to M. Duboscq Soleil, an optician of that city; who, struck with the advantages of applying the Stereoscope to photographic pictures, constructed a number of these instruments for that purpose. In the beginning of 1851, some were exhibited at one of the *soirées* of Lord Rosse, with Daguerréotype pictures, and the effect produced a considerable interest. From that moment the attention of English photographers was awakened, and M. Claudet immediately began to execute Daguerréotype pictures and portraits for the Stereoscope. M. Claudet then proceeded to explain how flat pictures could give the illusion of real models, with all the effect of relief and distance.

Photography on Wood.—Mr. Langton, of Manchester, has produced some beautiful specimens of Photography, taken upon Wood; by which process, portraits, landscapes, &c., could be produced on any smooth piece of wood, duly prepared; and thus even wooden snuff-boxes, hand-screens, &c., may be decorated with portraits, or scenes from nature, or copies of works of art, at a cost much less than Daguerréotypes on metal plates.

The Waxed Paper Process described by Dr. Percy, to the Photographic Society, will be found in the *Mechanics' Magazine*, No. 1553.

Natural History.

ZOOLOGY.

PROFESSOR AGASSIZ ON THE COLOUR OF ANIMALS.

PROF. AGASSIZ is of opinion that the coloration of the lower animals living in water, depends upon the condition, and particularly upon the depth and transparency of the water in which they live: that the coloration of the higher types of animals is intimately related to their structure; and that the change of colour which is produced by age in many animals is connected with structural changes. Coloration is valuable as an indication of structure; and it is a law universally true of vertebrated animals, that they have the colour of the back darker than that of the sides; and that the same system of coloration prevails in all the species of a genus, partially developed in some, but recognisable when a large number of species is examined. —*Jameson's Journal*, No. 109.

WEATHER AND DISEASE.

AT the late meeting of the British Association, Dr. Lankester, in connexion with the registration of the phenomena of life, as affected by changes in the weather, &c., called attention to an effort that was now making to register the occurrence of disease in conjunction with the state of the weather. Mr. Milner stated that season seemed to have an influence on the weight of man. He had weighed the prisoners in Hull gaol, for five years, and had found that they regularly increased in weight from April to November, and decreased in weight from November to March. The diet was the same all the year round, as was also the temperature. Dr. Fowler pointed out the importance of warm clothing and fresh air to longevity. He was now eighty-eight years old, and attributed his vigour to clothing himself warm and sleeping with his bed-room window open.

CHANGE IN THE COLOUR OF THE HAIR.

DR. ALLEN DARNELL, in a Dissertation which gained the Gold Medal in the University of Edinburgh, relates:—Grief, fear, and other emotions, are well known to alter the character of the secretions, and such mental conditions are also known to have been the proximate causes of these sudden changes in the hair. The hair of a lady, in my own family connexion, from some distressing circumstances which deeply affected her, became gray in a single night. A medical man in London, less than twenty years ago, under the fear of bankruptcy, had his dark hair so changed in the same period, that his friends failed to recognise him; but the colour in this instance returned as his worldly prospects revived. M. Roulin states that a friend of his, terrified by the prospect of losing his fortune, had the hair on the side on which he reposed turned to gray in a single night.

DISTRIBUTION OF THE BLOOD-VESSELS, &c., IN THE LUNGS.

Dr. James Newton Heale, in a paper read to the Royal Society, after referring to the discrepancies in the opinions entertained by anatomical writers, both with respect to the distribution and to the functions of the blood-vessels with which the lungs are supplied, gives the leading features in which the observations made by him differ from those which have hitherto been published; and, in conclusion states that sufficient has been adduced to confute the opinion that there is one set of vessels for the nutrition of the lung in its ordinary acceptation, and another for the respiratory function. Without doubt the bronchial (so-called) vessels and the pulmonary are distinct, both as to their distribution and functions; the one being for the purposes of breathing, while the other solely supplies the cellular tissue of the organ.

NATIVE AUSTRALIANS.

Two Australian men, natives of Cape York, Torres' Straits, have been exhibited to the Ethnological Society. They were brought to England, by Captain Strickland, of the *Scotia*. They are black, tall, handsome men, hair black, not curled, nose prominent, and but little spread over the face, lips not thick, stout broad chests, limbs, both upper and lower, less muscular than Europeans of the same stature. Mr. Brierly, who knew one of the men at Cape York, when he visited that part of the world, exhibited sketches, charts, and a panoramic drawing, showing Cape York, Evans' Bay, Port Albany, and islands in the neighbourhood, and containing drawings of canoes and natives. The two Australians at once recognised the drawing of their own coast, and exhibited great pleasure in looking at it. Mr. Brierly placed on the table an extensive vocabulary collected at Cape York, and others collected in the islands of Torres' Straits, also sketches of canoes and scenery of tropical Australia. The following, from Torres' Straits islands were likewise placed on the table—a tortoise-shell mask worn in their *kaubs* or dances, a native drum covered with lizard skin at one end, specimens of baskets, matting, rope made from creeping plants, fishing lines, hooks, large bamboo tobacco pipe, and various shell ornaments. Mr. Brierly described the several tribes, and their relative geographical position on the peninsula in the neighbourhood of Cape York. The curious raised scars (*Gori*) upon their shoulders and chests were exhibited to the Society, together with sketches of similar ones upon women. Mr. Brierly's descriptions had especial reference to the two Australians.

"EARTHMEN" FROM SOUTH AFRICA.

The so-called Earthmen, from the Orange-river, South Africa, have been exhibited and described to the Ethnological Society. They consist of a boy and girl, stated to be fourteen and sixteen years of age respectively, and are only three feet three and a half inches in stature. Their heads are well developed, and their figures are beautiful. Their actions are graceful. Their voices, words, laughter,

singing, action, and happy playing about the room, indicate them to be children. The evidence of their age obtained by Mr. George, who has the care of them, is unsatisfactory even to him, and therefore we rely on the evidence which the children themselves present. No ethnological writer admits of Earthmen in his works. The Honorary Secretary's opinion was received that they are young Hottentots.

ABORIGINES OF NEW HOLLAND.

Dr. Heywood Thomson has communicated to the Ethnological Society, a paper containing observations on some tribes in the neighbourhood of the Castlereagh and Lochlans branches of the River Macquarie, lat. 35° south, and long. 147° east; some on the tribes around Moreton Bay, lat. 27° south, and long. 153° east; the Broken Bay tribe near Sydney, lat. 34° south, and a tribe inhabiting Albany Island, Torres Straits, lat. 11° south, and long. 143° east. Several tribes which formerly inhabited the Castlereagh and Lochlans branches of the Macquarie are now extinct. The Castlereagh tribe now musters about one hundred; the Mole tribe, with the Darling River blacks, scarce two hundred; the Bogan blacks, about a hundred. Such are the miserable remains of tribes once numerous and powerful. These all possess the same physical characters as the tribes inhabiting the coast near Sydney, of which the Broken Bay and Hunter River may be selected as the types.—See the entire paper in the *Literary Gazette*, No. 1880.

AZTEC (?) CHILDREN.

Two strange children, a girl and a boy, were brought to London from the United States, in June last, and by aid of well-contrived advertisement and crafty puff, the adventurer, who exhibited the little folk, drew a considerable share of public attention to their fantastic tricks. They had their trumpet-tongued *avant-courier*, "the book," in which it was stated that the children were discovered in a mysterious city called Iximaya, in the unexplored and trans-Cordillera region of Vera Cruz,—in short, that they were the descendants of Aztecs driven out of Mexico by Cortez. A warm controversy was raised as to the historical evidence on the subject, by which means the public were led away from the main question. We can only quote such opinions as relate to the children themselves. Professor Owen gives the following as the result of his examination of the so-called Aztecs:—

"Their pure deep olive complexion, without admixture of the reddish or yellowish *rete mucosum* characteristic of the Indian races, indicates them to be of Spanish-Mexican parents; the long, glossy, jet-black hair, curled in natural ringlets, is still more opposed to the idea of the children being of pure Aztec or Indian Mexican origin. The complexion being lighter upon the trunk than upon the face, hands, and feet, indicates that the children had been clothed from infancy. The state of the dentition shows the boy to be about eleven years old, and the girl about seven or eight years. The chief peculiarities in these children are the abnormal arrest of development of the general stature, and the special arrest of development of the brain and brain-case, producing a size and shape of head like that in hemicephalous monsters. The absence of the power of continuous conversation, the paucity of terms, the want of power to connect the noun with the

verb in a definite proposition, and other signs of the inferior intellectual condition of the children, accord with this malformed state of the brain. Professor Owen detected other indications of a malformed state in the boy—viz., the congenital absence of one of the joints of the little finger in each hand; and a contracted state of the elbow-joint in both arms. The height of the boy is 36 inches, and his weight is 23 lbs.: the height of the girl is 31 inches, and her weight 20 lbs. The pulse in both is 80 per minute, becoming more rapid on exertion."

The Professor's general conclusion is that these children are not the representatives of any Aztec or other Indian race, but accidental instances of arrested growth and development of particular individuals, either of pure Spanish Mexican origin, or with some slight admixture of Indian blood.—*Literary Gazette*, No. 1904.

Dr. J. Warren, of Boston, has been led by his examination of them to the following conclusions:—

"1. That these children are possessed of a very low degree of mental and physical organization, but are not idiots of the lowest grade. 2. That they probably originated from parents belonging to some of the mixed Indian tribes. 3. That they do not belong to a race of dwarfs, because history teaches us the truth of the doctrine stated by Geoffroy St. Hilaire, that dwarfs cannot perpetuate their kind."

Mr. E. G. Squier thus corroborates Dr. Warren s view:—

"The Commandant of the Port of La Union, in the State of San Salvador, Central America, informs me that they were born somewhere near the town of Santa Ana, in that State, of parents, one of whom certainly, if not both, was dwarfed or deformed and imbecile. The Indians residing in the vicinity of Santa Ana are civilized, and centuries ago adopted Spanish customs and the Spanish language. So far as I could discover from a few words of their ancient language which came into my possession, they belong to the Choluctecan or Chorotegan stock, which, before the conquest, extended over a part of San Salvador, Honduras, and Nicaragua, but which was chiefly concentrated around the Gulf of Fonseca."

Dr. R. J. Latham, the Ethnologist, has stated to the British Association his opinion, as follows:—

"Considering that representations of heads similar to those of the two so-called Aztecs are found on certain Mexican monuments—that in the case of the Lacondon and Indians, on the frontiers of Vera Paly and Yucatan there is an actual instance of a still-existing imperfect independence: that there is special evidence to the existence of goitre in the localities around, it is considered that the individuals in question represent the American analogies of the European cretin, where the same conditions that have made arrest of development endemic, have preserved an imperfect independence."

NEW RODENT.

MR. WATERHOUSE has described to the Zoological Society a new species of Rodent from South America, remarkable for having a very short tail and strong fore-feet, furnished with large and nearly straight claws. It was from the province of Mendoza, having been recently sent by Mr. Bridges, after whom it was named by Mr. Waterhouse *Hesperomys Bridgesii.*

NEW RHINOCEROS.

A LETTER has been read to the Zoological Society, which had been addressed to Dr. Gray by Mr. Oswell, respecting the discovery of a Rhinoceros by himself and Captain Vardon, in the country about the river Limpopo, which they at the time considered to be a new species, as it probably is. The horns of this animal, brought home by Colonel Steele, and about to be presented by him to the British

Museum, were exhibited to the meeting. Their peculiarity consists in the forward direction of the lower horn, the end of which is evidently worn away by contact with the ground in feeding.

WHY DOES THE CHAMELEON CHANGE COLOUR?

Mr. H. N. Turner has, in the proceedings of the Zoological Society, and, more recently, in the October number of the *Annals of Natural History*, called attention to Van der Hoven's researches on the well-known colour-changing peculiarities of the Chameleon. Mr. Turner writes from personal observation of the phenomenon, having had a live chameleon for some time in his possession. It has been generally imagined that the purpose of this singular faculty accorded to the chameleon, is to enable it to accommodate its appearance to that of surrounding objects, but the observations of Van der Hoven and Turner do not favour the idea, but rather seem to negative it. The box in which Mr. Turner's chameleon was kept was of deal, with a glass at the top, and a piece of flannel laid at the bottom, a small branching stick being introduced by way of a perch. He introduced at various times pieces of coloured paper, covering the bottom of the box, of blue, yellow, and scarlet, but without the slightest effect upon the appearance of the animal. Considering that these primary colours were not such as it would be likely to be placed in contact with in a state of nature, he next tried a piece of green calico, but equally without result. The animal went through all its usual changes without their being in any way modified by the colours placed underneath it. The general tints approximate, as may be readily observed, to those of the branches of trees, just as those of most animals do to the places in which they dwell; but Turner did not observe the faculty of changing called into play with any apparent object. It is only when the light is removed that the animal assumes a colour which absorbs but little of it.

THE GREAT ANT-BEAR.

A fine living specimen of this comparatively rare animal has been exhibited in the Zoological Society's Gardens in the Regent's Park. It is stated to be the first specimen brought alive to England; and has accordingly excited considerable attention. In the *Literary Gazette*, No. 1916, we find the following scientific yet popular account of the animal, from the pen of a Cuvierian contributor:—

"When we were introduced to this, the latest novelty at the noble vivarium in the Regent's Park, we found the animal busy sucking and licking up—for his feeding is a combination of the two actions—the contents of a basin of squashed eggs. The singularly long and slender head, which looks more like a slightly-bent proboscis, or some such appendage to a head, was buried in the basin, and the end of the lithe and flexible tongue, like a rat's tail, or a writhing black worm, was ever and anon seen coiling up the sides of the basin, as it was rapidly protruded and withdrawn: the yellow yolk was dripping with the abundant ropy saliva secreted during the feeding process from the exceedingly small terminal mouth; for the jaws are not

slit open, as in the ordinary construction of the mouths of quadrupeds; and the head, viewed sideways, seems devoid of mouth: but this important aperture—by some deemed the essential character of an animal—is a small orifice or slit at the end of the tubular muzzle, just big enough, apparently, to let the vermiform tongue slip easily in and out. The tongue, the keeper told us, was sometimes protruded as far as fourteen inches from the mouth.

By the Qjuarani Indians the beast is known by the name "Youroumi," which D'Azara tells us* signifies in Spanish "boca chica," or "little mouth." The Portuguese and Spanish Peons call it "ramardoua," or by a name equivalent to "ant-bear." The systematic denomination of the animal in the Zoological Catalogues is *Myrmecophaga jubata*, or the "Maned Ant-eater." This appellation would very well suit the animal if, as most spectators commonly imagine at first sight, its head was where its tail is; for the latter appendage is that part of the animal on which the hair is most developed after the fashion of a mane, whilst the actual head appears much more like a tail, of a slender, almost naked, stiff, rounded kind. The body is wholly covered by long, coarse hair, resembling hay, rapidly lengthening from the neck backwards to six or eight inches, and extending vertically upwards from along the upper border of the long tail, and downwards from its under border, to the length of from ten to eighteen inches. The colour of the ant-bear is greyish brown, with an oblique black bland bordered with white on each shoulder. The animal measures about four feet from the snout to the root of the tail, and the tail is three feet long, resembling a large screen of coarse hair. When the animal lies down, it bends its head, which is about a foot in length, downwards and backwards between its fore-legs, slides these forwards and crosses them in front of the occiput, sinks its haunches by bending its hind-legs and bringing them close to the forefeet; then, leaning against the wall of its den on one side, it lays the broad tail over the other exposed side of the body, by a side-bend of that part, like the movement of a door or screen. Nothing is now visible of the animal but the long coarse hair of its natural and portable blanket. Those who may be so unlucky as to visit the animal when it is enjoying its siesta, will be unable to form any conception of its very peculiar shape and proportions—an oblong heap of a coarse, dry, greyish thatch is all that is visible. If, however, the keeper should luckily enter the den with any new dainty, in the shape of cockroaches, crickets, maggots, or meal-worms, to tempt the huge insectivore, the quick-hearing animal unveils its form by a sweeping movement of the thatch outwards; the tail that supports it rotating as if joined by a kind of door-hinge to the body; the head is drawn out from between the fore-limbs; the limbs are extended, and the entire figure of this most grotesque of quadrupeds stalks forth. The limbs are short; the fore-limbs grow rather thicker to their stumpy ends, which look as if the feet had been amputated. Not any of the figures that have been published

* *Histoire des Quadrupeds du Paraguay*, vol. i. p. 89.

of the beast give this characteristic; they have all, in fact, been taken from stuffed specimens. No trace of claws is visible where they are usually seen, at the fore part of what seems to be the foot, as applied to the ground; for the part so applied is the outer side of the foot, which is covered by a thick prominent callosity: the four toes, with their claws, are bent inwards, and are of very unequal length. We were very curious to inspect the conformation of this most singular part of the animal, which is also the most formidable member, and, indeed, bears the sole weapon of defence which the beast possesses. The innermost toe, answering to the thumb on the fore-limb of the neighbouring chimpanzee, is the shortest, being about an inch in length, and with a claw of half an inch. The second toe is two inches two-thirds long, with a claw of about two inches in length. The third toe is shorter but much thicker than the second; it measures to the base of the claw one inch two-thirds, but it supports a strong, curved, sharp-pointed claw of three inches in length, and about the same in the circumference of its base: this is the instrument by which the ant-eater mainly effects the breach in the walls of the termite fortresses, which it habitually besieges in order to prey upon their constructors and defenders. The great claw is bent inwards during the ordinary progression of the animal, in order to preserve its point and trenchant border in sharp working trim. The fourth toe, of equal length with the third, is much less strong, and is terminated by a claw of only half an inch in length. A fifth toe seems to be buried in the outside callosity on which the animal rests its stumpy foot while walking. At the back part of the sole, or what should be called the palm, of the fore-foot, is a second large callosity, which receives the point of the great claw in its usual state of inward inflection. Against this callosity the animal presses the claw when it seizes any object therewith, and Azara avers that nothing can make the ant-bear relax its grasp of an object so seized.

Travellers affirm that the jaguar is sometimes found dead, unable to extricate itself from the tenacious grasp of one of these great ant-eaters, which it had unwittingly attacked. The muscular force of all the animals of the low mammalian order, to which the myrmecophagæ belong, resembles that of the cold-blooded reptiles in the force and endurance of the contractile action; and, like the reptiles, the sloths and ant-bears can endure long fasts. The hind-feet of the maned ant-bear are actually as short and stumpy as they appear to be: at their fore part are seen five short claws: three close together in the middle, and the first and fifth smaller and a little apart from the rest: a slight tendency to an inward bending may be noticed in this foot: the heel is long, and the whole sole is callous, the animal being what is called plantigrade.

It walks slowly, and as if with pain, with its body almost touching the ground. Azara says, that when it is hard pushed it strikes off into a sort of gallop, but cannot attain to half the speed of a man running. When overtaken, you may keep him at his own speed by well-administered kicks; but, if too hard pressed, he squats on his broad haunches and threatens with his powerful fore-claws. Woe to

the unlucky or heedless aggressor whose arm or leg may be so seized! The strength of the grasp will sometimes break the bone: the ant-bear never voluntarily lets go, and the limb so grasped can be with difficulty extricated, even after the animal has been killed. To put the beast, however, *hors du combat*, no other weapon is needed than a stout stick: "With this," says Azara, "I have killed many by dealing them blows on the head, and with the same security as if I had struck the trunk of a tree. With a mouth so small, and formed as above described, the ant-bear cannot bite; and if it could, it would be useless, for it has no teeth. In this respect, and in the suctorial character of the mouth, which resembles that of a kangaroo in the pouch, the ant-bear retains throughout life unmature characters, which are transitory in higher organised quadrupeds. The eyes are small, rather sunk, the lids devoid of lashes, with a crescentic depression above and beneath them; the ears are rounded and short; the nostrils are large and crescentic; the tongue is slender, cylindrical, gradually tapering to a point, sixteen inches in length, and, when retracted, drawn into a sheath, which, with its muscles, extends beneath the neck and under the breast-bone.

Like a lawyer, the tongue is the chief organ by which this animal obtains its livelihood in its natural habitat. The warmer latitudes of South America, to which part of the world the ant-bear is peculiar, abound in forests and luxurious vegetation; the insects of the ant and termite tribes that subsist on wood, recent or decaying, equally abound. With one link in the chain of organic interdependencies is interlocked another; and, as the surplus vegetation sustains the surplus insect population, so a peculiar form of mammalian life finds the requisite conditions of existence in the task of restraining the undue multiplication of the wood-consuming insects. The great ant-bear seeks in preference the large and firmly-cemented fortifications of the white ants. Its makes a breach in these dwellings by means of its powerful fore-claw; and as the ants swarm forth it licks them up, and introduces them into its mouth by rapid movements of protrusion and retraction of the long tongue, which is lubricated by an adhesive saliva.

"No one," says Azara, "need wonder that so large a beast should be able to derive its sustenance from such minute prey, who is made aware of the myriads of the insects each ant-nest contains; and that in some districts these nests are crowded so as almost to touch each other." He adds, that "some persons have preserved the ant-bear alive, and have succeeded in transporting him alive to Spain, by feeding him with crumbs of bread, morsels of meat, and flour and water."

The specimen now exhibiting at the Zoological Gardens was one of a pair, captured near the Rio Negro, in the Southern Province of Brazil, and shipped for England by some German travellers. The male died on the voyage; the female arrived a short time since, and was exhibited in Broad-street, St. Giles's, until purchased by the spirited administrators of the Zoological Society's funds for the sum of £200. The Council, in effecting this purchase, have shown that

they comprehend their duties in a wide and liberal sense; and that not the least of these is to secure for exhibition, when possible, every rare animal which has not before been seen alive in England, irrespective of difficulties or expense in maintaining such acquisitions alive.

This animal has been engraved in the *Illustrated London News*, No. 648. The figure of the *Myrmecophaga jubata*, given by Buffon in the tenth volume of his great *Natural History*, in 4to, plate 29, as well as that subsequently published by Dr. Shaw in the *Museum Leverianum*, plate 12, were both derived from stuffed specimens, and have the inevitable defects and short-comings of such. All other figures, so far as we know, have been copies of these.

In conclusion, we may remark that, large as the ant-bear is in comparison with the animals on which it naturally feeds, there appear to have been still larger ant-bears in the old times of South America. Fossil remains of nearly allied quadrupeds have been detected in both the fresh-water deposits and bone-caves of the post-pliocene period in Buenos Ayres and Brazil.

Professor Owen detected in the fossil fragment of the back part of a skull, brought over, with other evidences of the extinct mammalia of South America, by Mr. Darwin, marks of affinities to the ant-eaters. The chief instrument in obtaining food in the existing ant-bear is its tongue; and this singularly elongated organ is more remarkable for its muscular structure and prehensile power than for its sense of taste. Now it appears that the tongue, in mammalia, has two principal nerves, one for movement and one for sensation, and that these nerves emerge by separate holes from the brain-case. The motor nerve (ninth pair in man) is proportionally very large in the ant-bear, and so, therefore, is the hole in the skull for its passage.

The great Cuvier, in his canons for the interpretation of fossil remains, had laid it down that "the first thing to be done in their study was to ascertain the form of the molar teeth."* But both jaws and teeth were wanting in the fossil under the consideration of our anatomist. He had to look out for other evidences. The first that seems to have arrested his attention was an unusually large and deep cavity in the portion of the skull to which the bone of the tongue is tied, and which led him to infer an unusual development of that organ. He next discovered "a more certain proof of the extent of its soft and especially muscular parts, in the magnitude of the foramen for the passage of the lingual or motor nerve. This foramen" was "fully twice the size of that which gave exit to the fifth nerve: its area was oval, and readily admitted the passage of the little finger."† Here, then, was evidence that the nervous matter destined to put in action the muscular part of the tongue was equal to half of that nervous matter which influences the whole muscular system of a man. No other known living animal offered any approximation

* "La première chose à faire dans l'étude d'un animal fossile est de reconnaître la forme de ses dents molaires."

† *Fossil Mammalia of the Voyage of the Beagle*, 1840. p. 58.

to the peculiar proportions of the lingual nerves of the fossil animal in question, except the great ant-eater; but the size of the animal indicated by the fossil was three times that of the *Myrmecophaga jubata.* For this strange monster, thus partially restored from the ruins of a former world, Professor Owen proposed the name of *Glossotherium,* which signifies tongue-beast.

Independent and contemporaneous evidence of such a creature was given by Dr. Lund, a Danish naturalist resident in Brazil. In a "View of the Fauna of Brazil, previous to the last Geological Revolution," the author thus intimates his discovery:—"Among the fossil remains here (limestone caves of the province Minas) I have discovered traces of the last-named genus (*Myrmecophaga*), which are, however, too imperfect to enable us to determine more accurately its relation to existing species. The fragments indicate an animal of the size of an ox; wherefore I propose for it the name *Myrmecophaga gigantea.*"* Were the insect prey of these antediluvian ant-eaters correspondingly gigantic?

Mr. Pettigrew has communicated to the *Literary Gazette,* No. 1917, the following additional notice from the "Travels through Spain," by Sir John Talbot Dillon, published in 1780, 4to. It is there stated that a specimen of the "Ant-bear, from Buenos Ayres, called by the Spaniards *Osa Palmera,* was alive at Madrid in 1776, and is now stuffed and preserved in this cabinet (Royal Cabinet of Natural History, Madrid). The people who brought it from Buenos Ayres says it differs from the ant-eater, which only feeds on emmets and other insects; whereas this would eat flesh when cut in small pieces, to the amount of four or five pounds. From the snout to the extremity of the tail this animal is two yards in length, and his height is about two feet. The head very narrow, the nose long and slender. The tongue is so singular, that it looks more like a worm, and extends above sixteen inches. His body is covered with long hair, of a dark brown, with white stripes on the shoulders; and when he sleeps he covers his body with his tail." p. 77. This account corresponds very accurately with that of the animal now exhibiting at the Zoological Gardens; and an exceedingly good representation of it is also given in Sir John Dillon's work, plate 2, not derived either from the publications of Buffon or Shaw, as stated in the *Gazette* to be the sources whence all others have been obtained.

I have been fortunate enough to see the present living specimen under great advantages, and was most particularly struck with two circumstances: the singular hinge-like manner in which the animal works its tail when having laid itself down, throwing it over the whole of its body, and enveloping itself completely; and the peculiar vibratory motion of the long vermiform tongue, when protruded from the mouth in search of food. The tongue is not shot forth and retracted, like that of the chameleon, but protruded gradually, and *vibrating* all the time, and in the same condition withdrawn into the mouth.

* Magazine of Natural History, new series, 1840, p. 21.

Mr. Wallace, who recently travelled on the Amazon and Rio Negro, relates in the *Literary Gazette*, No. 1918, "the living specimen of this singular animal is a great rarity even in its native country. In fact there is not a city in Brazil where it would not be considered almost as much a curiosity as it is here. In the extensive forests of the Amazon the great ant-eater is perhaps as abundant as in any part of South America, yet during a residence there of more than four years I never had an opportunity of seeing one. Once only I was nearly in at the death, finding a bunch of hairs from the tail of a specimen which had been killed (and eaten) a month previous to my arrival at a village near the Cassiquiare. In its native forests the creature feeds almost entirely on white ants, tearing open their nests with its powerful claws, and thrusting in its long and slender tongue, which, being probably mistaken for a worm, is immediately seized by scores of the inhabitants, who thus become an easy prey. The Indians, who also eat white ants, catch them in a somewhat similar manner, by pushing into the nest a grass-stalk, which the insects seize and hold on to most tenaciously. It may easily be conceived that such a large animal must range over a considerable extent of country to obtain a plentiful supply of such food, which circumstance, as well as its extreme shyness and timidity, causes it to be but rarely met with, and still more rarely obtained alive."

INSTINCT IN BIRDS.

THE Rev. F. Statham has communicated to the British Association, a curious Exemplification of Instinct in Birds. The author made some references to the theory of the facial angle, as indicative of the amount of sagacity observable in the animal race,—but expressed his conviction that this theory was utterly at fault in the case of birds: many of those having a very acute facial angle being considerably more intelligent than others having scarcely any facial angle at all. Size also seemed to present another anomaly between the two races of beasts and birds—for while the elephant and the horse were among the most distinguished of quadrupeds for sagacity and instinct, the larger birds seemed scarcely comparable to the smaller ones in the possession of these attributes. The writer instanced this by comparing the ostrich and the goose with the wren, the robin, the canary, the pigeon, and the crow; and made some amusing allusions to the holding of parliaments or convocations by birds of the last species, while the ostrich is characterized in Scripture as the type of folly. The author then referred to the poisoning of two young blackbirds by the parent birds when they found that they could neither liberate them nor permanently share their captivity. The two fledgelings had been taken from a blackbird's nest in the garden of S. Swonnell, Esq., of Surrey Square, London, and had been placed in a room overlooking the garden, in a wicker cage. For some time the old birds attended to their wants, visited them regularly, and fed them with appropriate food; but at last, getting wearied of the task, or despairing of effecting their liberation, they appeared to have poisoned them. They were both found suddenly

dead one morning shortly after having been seen in good health; and on opening their bodies, a small leaf—supposed to be that of *Solanum nigrum*—was found in the stomach of each. The old birds immediately deserted the spot, as though aware of the nefarious deed befitting their name.

The reading of this paper led to the notice of several instances of instinct amongst animals. Dr. Horner stated that rooks built in the Infirmary trees at Hull, but never over the street. One year, a young couple ventured to build over the street, and for eight mornings in succession the older rooks proceeded to destroy the nest, when at last the young ones chose a more fitting place. Mr. A. Strickland, after referring to the tendency of birds to build their nests of materials of a colour resembling that around their nests, related an instance in which the fly-catcher had built in a red-brick wall, and used for the nest mahogany shavings. He also referred to the meetings of rooks for judicial purposes. He had once seen a rook tried in this way, and ultimately killed by the rest. Dr. Redfern drew attention to the distinction to be made between instinct, intelligence, and reason. Instinctive actions were dependent on the nerves, intelligence on the brain, but that which constituted the peculiar qualities of the mind of man had no material organ. Mr. Allis stated, that in proportion as the brain was developed in relation to their size in birds, was their intelligence. Thus, the goose and ostrich had small brains,—but the canary and wren very large ones. —*Athenæum.*

THE UMBRELLA BIRD.

Mr. Wallam, in his *Travels on the Amazon,* describes this singular bird to be about the size of a raven, and of a similar colour, but its feathers have a more scaly appearance, from being margined with a different shade of glossy blue. It is also allied to the crows in its structure, being very similar to them in its feet and bill. On its head it bears a crest, different from that of any other bird. It is formed of feathers more than two inches long, very thickly set, and with hairy plumes curving over at the end. These can be laid back so as to be hardly visible, or can be erected and spread out on every side, forming a hemispherical, or rather a hemiellipsoidal dome completely covering the head, and even reaching beyond the point of the beak; the individual feathers then stand out something like the down-bearing seeds of the dandelion. Besides this, there is another ornamental appendage on the breast, formed by a fleshy tubercle, as thick as a quill and an inch and a half long, which hangs down from the neck, and is thickly covered with glossy feathers, forming a large pendant plume or tassel. This also the bird can either press to its breast, so as to be scarcely visible, or can swell out, so as almost to conceal the forepart of its body. In the female the crest and the neck-plume are less developed, and she is altogether a smaller and much less handsome bird. It inhabits the flooded islands of the Rio Negro and the Solimoes, never appearing on the mainland. It

feeds on fruits, and utters a loud, hoarse cry, like some deep musical instrument; whence its Indian name, *Ueramimbé*, "trumpet bird."

HUNGARIAN NIGHTINGALE.

Last autumn, says Dr. Martin Barry, I brought from the neighbourhood of Hungary a Nightingale, *Sylvia Philomela*. It wintered in Scotland—I will venture to say the only one there; and then, after two months of powerful and most delicious songs in its cage, it died.—*Jameson's Journal*, October, 1853.

GUANO BIRDS OF THE LOBOS ISLANDS.

Along the sea-coast of Peru and Bolivia, within the tropic of Capricorn, says Dr. Hamilton, countless numbers of aquatic fowls exist which live on fish, and whose excretions are exceedingly fertilizing. In some localities, the number of guanos is enormous, so that when alarmed by discharges of fire-arms, or otherwise, they rise from their resting-places in such masses as cannot be supposed by those who have never seen these birds darkening the air like a cloud. Guano producers change their habitation when continuously disturbed, but they do not permanently leave a locality which has long been frequented by them in consequence of a temporary alarm; for, in such a case, they soon return to their old haunts, and totally abandon them only when teased by lasting annoyances. The ocean on the west coast of South America, within the tropics, teems with fish, the quantity seeming exhaustless, and guanos equally abound, so that their egesta is gradually accumulating somewhere either on or off that desert land, and now has become an object sought after, not only by the Peruvian mountaineer, but by the merchant, shipowner, and statesman.—*Jameson's Journal*, No. 108.

VULTURES.

Mr. H. A. Walter has exhibited to the Zoological Society a series of the eggs of vultures, from his own cabinet, for the purpose of comparison. The immediate object he had in view was to introduce to the notice of the meeting an egg of *Otogyps auricularis*, which he believes to be the only specimen as yet existing in this country, and, in fact, he is only acquainted with two others in the collections of the Continent. The Society possesses living examples of every genus of vultures, with the single exception of Neophron, the Egyptian Vulture, which will be added to the menagerie without difficulty during the ensuing summer. Mr. Walter also exhibited the eggs of several other rare species of birds, which are at present living in the Society's menagerie; including the Great Snow Partridge of Persia, the Kep-ke-dereh, presented to the Society by Mr. Stevens, her Majesty's Vice-Consul at Tabreez. A beautiful drawing, by Mr. Wolf, of this fine bird was on the table. The most remarkable egg was that of the Tui-Bird (*Prosthemadera Novæ Zealandiæ*), which was described for the first time, and is unique in Mr. Walter's collection. The Tui-Bird, now in the Society's possession, has lived in the menagerie for upwards of four years.

TOUCANS.

Mr. Gould has exhibited to the Zoological Society a nearly complete collection of the family of Ramphastidæ, or Toucans, including fifteen species not yet figured in his monograph. After pointing out the characters which distinguish the generic groups into which he separates them, he took occasion to describe a singular addition to those previously known, conspicuously marked by a patch of bright blue on the throat, it belongs to the genus Aulacorhamphus, and received the name of *A. cœruleogularis.* It was collected in Veragua, by Mr. Seemann, during the voyage of her Majesty's surveying ship *Herald.* The Society's menagerie contains three fine species of toucans—*Rhamphastos toco erythrorhynchus* and *ariel.* These very interesting birds are in perfect health, and even during severe weather take exercise every day in the open air in the great aviary.

MENURA ALBERTI.

Mr. Gould has exhibited and described to the Zoological Society, the nest and eggs of *Menura Alberti,* from specimens transmitted to this country by Mr. Willcox, of Sydney. The structure of the nest fully corroborated the views which Mr. Gould had developed many years since as to the position of *Menura* among the incessorial birds, in contradistinction to those of Temminck, Illiger, Swainson, and Lesson. The *Menura,* according to Mr. Willcox, only lays one egg, but on that point there exists some doubt. The egg of the old species, *Menura superba,* is still unknown.

THE DODO.

There has been read to the Zoological Society, a very interesting "Notice of an Original Painting, including a figure of the Dodo," in the collection of his Grace the Duke of Northumberland, at Syon House, by W. J. Broderip, Esq., V.R.Z.S. &c. (See *Literary Gazette,* No. 1891, where the bird is engraved.) The size of the picture, which is in the finest preservation, is 32 inches by 19 inches. It oppears to have been the joint production of Dee Heem and Jean Goeimare; the landscape and animals were painted by Goeimare, and the shells by Dee Heem. In this picture, which seems to have been intended as a record of varieties, the foreground represents a sea-shore from which the tide has retired, leaving empty shells of the following genera:—Nautilus, Pteroceras, Strombus, Triton, Pyrula, Capis, Cypreæ, Comus, Mitra, Tarbo, Nerita Mytilus, Ostrea, &c. Behind, on elevated ground, are two ostriches, and below to the right of the spectator, the Dodo is represented as in the act of picking up something from the Strand. The head and body of the bird, covering an area as large as the palm of a man's hand, are seen; but the legs are hidden. The painter of the Dodo, in a picture belonging to Mr. Broderip, has given the only complete foreshortened back view of the bird known to him. In the Duke's picture the head and body are represented to the spectator on a larger scale, and Mr. Broderip has nowhere seen the hood or ridge

at the base of the bill, from which the bird obtained the name of *Cygnus cucullatus*, so clearly represented.

NESTS OF HUMMING BIRDS.

MR. GOULD has exhibited to the Zoological Society a collection of the Nests of Humming Birds, exemplifying the habitual characteristic structure of several genera. The first group to which his remarks were directed were the Hermit Birds (*Phaëthornis*), who invariably build at the extremity of leaves, perhaps from the protection which that situation affords against the attack of monkeys and other predatory animals. *Oreotrochilus* builds a beautiful nest attached to the side of a rock. *Heliomaster Mesoleucus* makes a nest in a beautiful species of moss of the genus *Usna*, depending from the trees of the Brazilian forest. Most of the nests are cup-shaped, some in forks, some in branches, some on leaves, some in ferns, shallow and delicately formed, ornamented in the most various manner with feathers, or with festoons of moss and of lichen, especially in the genus *Hylocharis*. The differences in the eggs of Humming Birds are not very observable, being invariably two in number, white and oblong, with one supposed exception—namely, a species inhabiting the Upper Amazon, which, according to Mr. Edwards, lays a spotted egg. But the difference of structure of the nests sufficiently corroborate the generic divisions into which these birds have been separated by modern ornithologists. The attachment of the lichen, and other ornaments, is effected by the use of fine cobwebs. The humming birds generally place their nests in open situations, regardless of the intrusion of man, to which, however, the remote localities occupied by many of the species but little expose them. They have a little sharp note, which, although similar, has sufficient variety to enable the collectors to decide that they are within the range of a new species before they have seen it. Most of the nests exhibited were from the collection of Mr. Reeves of Rio, who liberally presented them to Mr. Gould, with a view to assisting him in rendering his splendid monograph of this family as complete as possible.

NEW HUMMING BIRDS.

MR. GOULD has exhibited to the Zoological Society four new species of Humming Birds. Three of them from the eastern slope of the Andes, remarkable alike for their size and their extraordinary beauty. They were collected by Mr. Warczweick. The first species was a large fork-tailed bird, nearly six inches in length, with a magnificently coloured crown, the forehead being green succeeded by rich orange, and terminating posteriorly in rich blue, all of a highly metallic lustre ; the throat, neck and chest green, with a small gorget of purple in the centre of the former ; the posterior part of the body and tail cinnamon red. To this fine species he gave the name of *Helianthea Iris.* The second species is nearly equal to the former in size, with the crown of the head rich metallic green, while the throat (which is destitute of the blue gorget) and the back of the neck are

also green, but less lustrous than the crown; the body and tail are also cinnamon red, as in the preceding, but not so deep. To this bird the name of *Helianthea Aurora* was assigned. The third is also of large size for a humming-bird, being nearly five inches in length, with the whole of the throat and upper part of the chest of the most beautiful violet, a spot on the forehead brilliant verditer green; the neck, back, and abdomen green, and the tail, which is considerably forked, black. To this species, which is somewhat allied to *Heliangelus Parzduka*, he gave the name of *H. viola*. For a fourth species, nearly allied to *Trochilus Franciæ*, he proposed the specific appellation of *Trochilus* (——?) *Cyanocollis*. It has the entire under-surface snow-white, and the crown of the head and the sides of the neck blue. He next described a small species lately received from M. Linden, of Brussels, with a grey throat passing into rufous on the abdomen, and presenting generally a very sombre appearance, except on the crown where a peach-blossom line appears, suggesting the appellation of *Trochilus floriceps*. It was collected on the Sierra Nevada of Santa Martha, at an elevation of 5000 feet.

TETRAOGALLUS.

Mr. Gould has exhibited to the Zoological Society four species of *Tetraogallus*, including a new one from the collection of the Hon. East India Company, obtained in Ladak, which differs essentially from the older species by its smaller size, its orange legs, and its sides being streaked with black, instead of tender chesnut. The name proposed for it is *T. Thibetanus*. The whole of the species live in temperate or snowy regions of the Himalaya and Caucasus, and the fine health in which *T. Caucasiens* has been for several months preserved in the Society's menagerie would indicate that the whole of them might be acclimated in the Scotch and Cumberland mountains.

THE DUSKY PETREL.

Mr. Yarrell has exhibited to the Linnæan Society specimens belonging to Mrs. Blackburn, of the Dusky Petrel, *Puffinus obscurus*, of modern authors. This bird, new to the British islands, flew on board a small sloop off the island of Valentia, on the south-west coast of Ireland, on the evening of the 11th of May last. It is not recorded to have been killed more than four times in Europe; it is common at the Azores and at the Canaries, and is said to go from thence southwards to the Cape of Good Hope. According to Audubon and Nuttall, it is plentiful in the Gulf of Mexico, going north to Long Island, and by the west side, on the coast of the Pacific. It was found by Captain Cook on Christmas Island. Mr. Gould mentions it as inhabiting Norfolk Island and the shores of New Zealand. Sir Thomas Mitchell has presented to the British Museum specimens brought from Eastern Australia; and in the Leverian Museum was one from King George's Sound. This species having been frequently confounded with the Manx petrel, *Puffinus Anglorum*, from their close resemblance in plumage, a specimen of the Manx

petrel, with the eggs of both, were likewise exhibited for comparison. —*Literary Gazette*, No. 1880.

THE GREAT BUSTARD.

Mr. Yarrell has read to the Linnæan Society, a paper on the "Habits and Structure of the Great Bustard *(Otis Isorda)*." This bird, which was formerly very plentiful in Great Britain, is now very scarce. Two instances had come to the author's notice of its having been recently found in England,—one seen by Mr. Waterhouse on Salisbury Plain, and a specimen shot by Dr. Plomley, at Romsey Marsh. He read notes on the habits of the bird from several correspondents. Mr. Nicholson had seen this bird in Spain, near Seville. The males arrive in flocks from seven to fifty in number in February,—the females singly in April. In May the male birds retire again; the young are hatched in June,—and all disappear in July. They are good eating. He had shot one weighing twenty-eight pounds. Two had been seen in the neighbourhood of Salisbury in 1801. One was taken after having attacked a house. It lived many years afterwards in confinement. It ate sparrows and mice, as well as vegetable food. At the beginning of the present century, Mr. Nash says that he had seen as many as nine flocks of bustards in a single dav, near Thetford, in Norfolk. The author alluded to the fact, that Dr. Douglass had described the male of this bird as possessing a gular pouch, in which it carries water. It was supposed to carry the water about with it to supply its need in the arid districts in which it is found,—and also as a means of defence. A preparation of the throat of a male bird which had died at the Zoological Gardens was exhibited, in which no gular pouch could be detected. Other anatomists had also looked for this pouch in vain. The author in his work on "British Birds" had followed Dr. Douglass,—but he was now convinced that the description must have applied to some other bird. Mr. Gould exhibited a drawing of the Australian type of the genus Otis, and stated that he had failed to discover in that bird any pouch such as had been described. The Australian species was excellent eating, and in great abundance,—and he and his party had subsisted principally on them for several months.—*Athenæum*, No. 1318.

PISCICULTURE.

M. de Quatrefages has communicated to the Paris Academy of Sciences some important researches bearing on different points connected with the artificial fecundation of the eggs of fishes. Assisted by M. Millet, he has first shown that the temperature of the water for fecundation, requires special attention. This temperature varies for each species, and it is well to ascertain it for each separately. In general, for the winter fish, as trout, it is between 6° and 8° C.; for the early spring fishes, as pike, 8° to 10°; for the later spring, as perch, 14° to 16° C.; and finally, for the fishes of summer, as the barbel, 20° to 25° C. The necessity of a specific temperature is connected also

with the vitality of the spermatozoids of different species, which is of short duration, it not exceeding eight minutes in the pike, whilst in man it lasts eight hours. The maximum temperature for the spermatozoids of the pike has been obtained at + 2° C.; a higher temperature destroys them rapidly. The spawn of the pike is kept perfectly well in ice-water, and the spermatozoids perish only with a cold below 10° or 12°. The influence of temperature on the vitality of the spermatozoids of fishes, and therefore on the fecundation of eggs, presents a reason for the instinct which urges some fishes to ascend streams, and at times to penetrate into rivulets where they have hardly enough water for their movements. M. de Quatrefages deduces some rules which are important to the art of pisciculture, bearing especially upon the preservation of the spawn. 1. The water should not be supplied with the spawn in advance; it is well to leave the spawn in place even till the moment of employing it, and the fecundation should follow soon, upon the death of the male fish. 2. Since the fecundation should take place within a day or twelve hours after the death of the animal, the spawn should be then taken and kept separate. 3. To preserve the spawn, it should not be placed in the water, or in the open air, but better in a moist linen cloth, which is kept at a temperature equal to, or a little below that, which for each species gives the maximum duration to the movements of the spermatozoids. 4. If there are several fecundations to operate successively, it is necessary to detach for each, the quantity of spawn required, and leave the rest in some convenient place. – *Correspondent of Silliman's Journal.*

PROPAGATION OF SALMON.

Mr. Hogg has read to the Zoological Society, a paper "On the Artificial Breeding of Salmon and Trout, with remarks on the modes of Fecundating their Ova." This paper gave a further account of the Artificial Breeding of Salmon, as practised by Isaac Fisher, Esq., in the river Swale, in Yorkshire, with success, during the last winter and spring. A letter from that gentleman was read, stating that Major Wade, of Hauxwell-Hall, had succeeded in breeding artificially from trout. Mr. Fisher also referred to what he considered an incorrect statement in a newspaper, concerning a Dr. Robertson, in Scotland, having "taken some roe from a female salmon without milting it, and that it had produced the fry." Mr. J. Hogg read the account itself, as published in the *Perth Courier*, in April, 1853, and which said that Dr. Robertson, "conceiving that the ova of the female were impregnated, previous to their development, within the body of the fish," took some "live female trout from the spawning-bed, and having extracted the roes, deposited them in a perforated zinc-box," which was placed in a running stream in October last, and he found in April that several of the ova had hatched. The author then considered that this alleged experiment of Dr. Robertson could only be solved by one of the following methods:—First, that the ova of the female trout had in some way received the influence of the fecundating principle of the male trout previous to Dr. Robert-

son's depositing them in his perforated zinc box; or, second, that the perforated zinc box, which contained the ova, as expressed from the females, was placed in the running stream, within the fecundating influence of the males; and of these two solutions Mr. J. Hogg gave detailed explanations. He concluded by stating, that, as there were doubts respecting the processes which the female salmon and trout naturally adopt, at the spawning season with the males, experiments on this subject could readily be undertaken by confining them, at the proper time, in large glass cases, covered with wire-gauze, like those which have so recently been erected in the Water Vivary at the Zoological Gardens, and for which he proposed the word Hydrozogrium, derived from *ὕδωρ*, *aqua*, and *ζωγρεῖον*, *vivarium*.

"FÉCONDATION ARTIFICIELLE DES ŒUFS DE POISSONS." BY DR. HAXO.

THIS work is stated in the *Literary Gazette*, to be the best account yet published in France of the discovery of Artificially Fecundating the Eggs of Fish, made some time ago by two fishermen, named Rémy and Gehin, of that country—a discovery which, as the reader is no doubt aware, enables fish to be multiplied in rivers by hundreds of thousands.

DOLPHIN OIL.

A NOTE has been read to the Zoological Society, on the capture of *Delphinus orca*, in South Greenland, by Mr. Rehüller, of Thorrhaven, which was communicated by Sir Walter Trevelyan, to whom it was addressed. It contained the description of a method of capturing these animals with a net, which had proved so successful that the number taken in Westmanharn alone since 1843 (when the net was first used) amounted to 2200, whereas between 1843 and 1849, 280 only had been secured. As each animal is taken to average 30 gallons of oil, this branch of industry has produced upwards of £4000 sterling to the inhabitants of Westmanharn in the last ten years.

WATER SHRIMP.

MR. WESTWOOD has read to the Linnæan Society, a paper "On the presence of a species of Water Shrimp, hitherto unknown in England, in a Well, near Maidenhead." The author believed it to be identical with the *Niphargia stygia* of Schiödle—a shrimp which had hitherto been discovered only in the caverns of Carniola, where also the *Proteus anguinus* is found. Mr. Westwood drew attention to the fact of the absence of eyes in this genus, and referred to the researches of various naturalists, from which it appears that fish and other animals living in subterranean waters are blind, or nearly so.

THE AQUATIC VIVARIUM.

ON the borders of the flower bed in the Zoological Gardens, Regent's-park, has been constructed, crystal-palace fashion, of glass and iron, a light airy building, 60 by 20 feet in area, containing

around its transparent walls, fourteen 6-feet tanks of plate glass. Eight tanks are devoted to living marine animals. They inclose masses of rock, sand, gravel, corallines, sea-weed, and sea-water; and are abundantly stocked with *Crustacea, Star-fish, Sea-eggs, Actinias, Ascidians, Shelled and Shell-less Mollusks,* and fish of the genera *Gasterosteus, Labrus, Crenilabrus, Blennius, Gobius,* and *Cottus.* The whole are in a state of natural restlessness, now quiescent, now eating and being eaten. Here may be seen a brilliantly-coloured *Actinia,* expanding its numerous tentacles, and there a *Pecten,* open-valved; here a *Littorina,* crawling stealthily along a rock-crevice, there a *Balanus* waving its graceful cirri; while the more active of the fish and of the shrimp-like crustacea give variety to the scene.

The *Algæ,* which serve at once as ornaments and shelter for the animals, and as purifiers of the water, appear to bear their new situation as well as the lively zoophytes. The collection is altogether from the British seas, but the building is so constructed as to be capable of being enlarged, and the society does not despair of exhibiting some of the more striking tropical and intertropical forms of invertebrate animals.

The most complete portion of the collection are the *Actinias,* among which the specimens of *A. dianthus, parasitica, crassicornis,* are truly magnificent. The rare *Adansia palliata, Actinia nivea, A. miniata,* are also objects which merit more than passing attention. The tank in which they are grouped together presents a splendid harmony of colour hardly to be surpassed by the hues of a skilfully-dressed flower-garden. The shelled mollusks are indicated rather than represented, but the vivacity displayed by the *Pectens* and *Littorina* are a sufficient guarantee for what may be done with them hereafter. The star-fish appear to be rather more difficult in treatment, but among those displayed in the tank appropriated to them, are two fine specimens of *Palmipes membranaceus,* which occasionally fix themselves against the glass walls, and exhibit their exquisite structure and bright crimson margin most admirably. *Echini* are not unfrequent, and gorgeously coloured *Ophiocomas* and *Solasters* brighten up the dark stones and shaded recesses of the *Algæ* with an effulgence which is irresistibly charming. A few *Holothurias* complete the series of this division of the British *Radiata,* which the work of Professor Edward Forbes has rendered more popularly known than any other. The crustacea, too, which occupy the adjoining tank, are as numerous in species as they are lively in action, although the secluded habits of many of them prevent more than a small number being visible at one time.

One of the most interesting features in this novel exhibition is the restless change of position among the several creatures. The visitor may occupy the whole day in passing inside and outside the building from tank to tank, and yet every time see something new. The tanks, visible on both sides, afford 390 square feet of view, and contain seven tons of sea-water. Of the marine fish, of which the *Blennies* and *Cotti* are almost always at the bottom, it may be said that their habits are being now, for the first time, investigated with

success; and their activity and rapacity present effects so curious that the most casual observer cannot help being struck with them. This exhibition of living fish and invertebrates, besides exciting much curiosity, will be of most impressive usefulness to the student, to whom they have been only known hitherto by books and dried remains. The public have thronged to it astonishingly, during one week exceeding 40,000 in number; and greatly are they indebted to Mr. Mitchell, the active secretary of the society, for his zeal and admirable taste in the matter.—*Literary Gazette*, No. 1897.

Two well-executed engravings of this Vivarium, carefully drawn by Samuel Read, have appeared in a late number of the *Illustrated London News*.

THE OYSTER TRADE OF NEW YORK.

The following curious details respecting this branch of commerce is from the *New York Herald* :—The yearly sales of oysters in this city exceed five millions of dollars, and the number of persons employed in the business, directly or indirectly, is about fifty thousand. Of the whole amount of oysters sold in our markets, about two-thirds come from Virginia. One of the most interesting features in the business is the transplanting of oysters, or their removal from the "rock," or natural bed to an artificial one. More than a million dollars' worth are removed every year to artificial beds, and by this means prevented from spawning, which renders them unfit for use.

ARTIFICIAL PEARLS.

In a recent number of the *Journal of the Society of Arts*, it was stated that "an oyster, or rather a mussel, of the species known to naturalists as the *myamargaritifera*, in which the artificial pearls are formed by the Chinese, had recently been sent to this country." These pearls are only obtained near Ning-po, and until lately, very little was known of the manner in which they were formed; and the account first published by Sir Joseph Banks was generally questioned. The *Hermes* steamer, however, on a late visit to that place, was able to obtain several live ones, in which, on being opened, several pearls, as many as eighteen or twenty, were found in the course of formation. The one sent only contains simple pearls adhering to the shell. It appears they are formed by introducing some pieces of wood or baked earth into the animal while alive, which irritating it, causes it to cover the extraneous substance with a pearly deposit. Little figures made of metal are frequently introduced, and, when covered with the deposit, are valued by the Chinese as charms. These figures generally represent Buddha in the sitting position, in which that image is most frequently portrayed. Several specimens have, it is said, been preserved alive in spirits, and others slightly opened, so as to show the pearls.

MOLLUSCA.

Dr. Gray has read to the Zoological Society a paper on the

division of *Stenobranchiate gasteropodous Mollusca*,—in which he made use of the character afforded by the mouth, which he considers to establish the distinction of two great groups, in a much more natural manner than the presence or absence of a syphon in the mantle, and to be more consistent with the habits of the animals, and much less liable to exceptions. The character on which Dr. Gray chiefly relies, is, the form, disposition, and number of the teeth on the lingual membrane. M. Deshayes made some observations upon the manner in which the animals of these groups take their prey.

REPRODUCTION OF THE TOAD AND FROG.

A PAPER by Mr. E. J. Lowe, F.G.S. has been communicated to the Royal Society. It contains some remarks contrary to the generally received notion of the procreation of these reptiles. Ray, and most naturalists, at least consider toads and frogs as oviparous animals, yet it is apparent that they are viviparous as well, or if they do not bring forth their young alive, have the power of reproduction in a different manner to the ova and subsequent tadpole.

Mr. J. Higginbottom, of Nottingham, who has paid great attention to this subject, has clearly proved the development of the tadpole to the perfect toad in situations wholly deprived of light, as Mr. Lowe has several times witnessed. The present remarks are intended to show that *occasionally* frogs and toads are reproduced in localities where it would be impossible for the intermediate stage of tadpole to have any existence.

Mr. Lowe's remarks show the probability that frogs are occasionally born alive in situations where no water can be found for the spawn to be deposited in; and that toads are either reproduced in the same manner, or from the egg directly. The latter mode seems most likely, owing to spawn having been found previously to the young toads.

Mr. Higginbottom states that the same remark on the birth of the Triton, without the stage of tadpole, has been mentioned to him.

DISCOVERY OF A FROG IN NEW ZEALAND.

DIEFFENBACH, in his Travels, states that he saw neither toads nor frogs in New Zealand. The Rev. Mr. Taylor, in his "Leaf from the Natural History of New Zealand," makes no mention of frogs. Dr. Sinclair, who has contributed so much to the Fauna of New Zealand, states, that he never saw or heard of a frog in the country; and the missionaries and natives declare that they had never either seen a frog, or heard the croak of one. Hence it was generally believed that frogs did not exist in New Zealand. However, in October, 1852, four frogs were found by a party of gold-diggers, in the hills around the harbour of Coromandel. They were shown to many of the natives, one of whom was Taniwha, a celebrated chief, who recollected Captain Cook's last visit to the country. None of these individuals had ever seen the animal before, nor could they give any name to it. When the character of the now almost extinct

native rat in New Zealand became known, it furnished a link in the chain of evidence regarding the countries from whence the New Zealand race originally came; and the discovery of the frog may throw a ray of light on some obscure geological questions in New Zealand.—*Jameson's Journal*, No. 109.

INSECTS ATTACKING VINES.

MR. JOHN CURTIS has read to the Linnæan Society "A Note regarding the Weevil of the Vine, and its Parasite." The injury sustained by the vineyards in the south of Europe from the attacks of insects, has long occupied the attention of naturalists, and their history and economy have been ably investigated by Messrs. Walckenaer and Andouin. Among the beetles, a weevil (*attelabus betuleti*, Fabr.) sometimes does very extensive mischief to the vines of Burgundy, whilst in England it feeds upon the birch. In June last, Mr. Curtis's attention was directed to the vines in the Botanic Gardens at Genoa, which were attacked with mildew; when he saw the leaves of the vines rolled up like cigars. Dr. Debey describes how the attelabus betulæ generally cut and roll the leaves with mathematical precision; and Mr. Curtis stated that the female weevils cut the leaf through, across the transverse diameter, without dividing the midrib, deposit an egg or two upon the upper surface, and subsequently roll up the lower portion, leaving the upper part untouched, so that it remains green for a considerable time. The attelabus betuleti, however, seems to differ in her mode of manipulation from the attelabus betulæ, and most other weevils; since the author observed in this case no cutting transversely, the entire leaf appearing to be rolled up from the base to the tip. Mr. Curtis then called attention to a memoir by Professor Filippi, of Turin, relative to a minute hymenopterous insect, whose province it is to keep down the multiplication of attelabus betuleti. This little four-winged fly, probably a pteromalus, contrives to lay its eggs in those of the weevil; but the most extraordinary part of M. Filippi's discovery is, that a still smaller insect, of the same family, deposits an egg in that of the parasite, so that the maggot of the first parasite becomes the food of the second. It is a curious question, says Mr. Curtis, how, when, and where the egg of the second parasite is introduced into that of the first. We are well aware that many minute hymenoptera puncture the eggs of other insects to deposit their own; but we never before heard of these being again punctured by other parasites. The author concluded by pointing out the great importance to those engaged in the pursuits of agriculture and horticulture, of becoming accurately acquainted with the economy of parasitic insects, by whose agency other noxious insects are rendered much less destructive than they must otherwise become, if unchecked in their multiplication. At the request of Mr. Curtis, the secretary (Mr. Bennett) afterwards translated from the original Italian, and read to the meeting, part of Professor Filippi's very interesting memoir, by which it appeared that the views attributed to him by Mr. Curtis, and which he had, in point of fact, originally entertained, had, on further exa-

mination, been considerably modified, he having eventually come to the conclusion that the two larvæ above described belong to one and the same species, and afford a very remarkable instance of what Steenstrup has called "the alternation of generations," the pteromalus, not producing, in the first instance, creatures like itself, but intermediate beings, which are the mothers of other offsprings, which are capable of being developed into perfect pteromali. These intermediate beings have received from Steenstrup the name of "nurses." It has long been known that aphides, or plant-lice, possess the wonderful property of generating other fertile and viviparous aphides without copulation, as in the case of the pteromalus the first larva generates the second; but M. Filippi points out that there is a remarkable difference between the two cases; the viviparous aphides must be considered as females in which the eggs are developed by the remote influence of a copulation between their parents, grandparents, or still more distant ancestors, to which the successive generations of progeny all bear a close resemblance, whilst the first larva of the pteromalus is entirely destitute of sexual characters, to say nothing of the immense differences of external conformation between it and the winged insect whence it proceeds, and which it is destined to reproduce.

NEW SILK INSECT.

Mr. Westwood has exhibited to the Entomological Society specimens of the silk produced by this new insect, which were in different stages of manufacture. The insect is a native of western tropical Africa, whence the specimens were recently imported. Mr. Westwood has also figured and described the insect in the *Gardener's Chronicle.*

The silk is described by the Rev. Henry Venn, as a kind of wild silk extensively used in the manufactures by the natives. "It was communicated by a native negro, who received a few months' instruction in this country, including medical teaching, and who is now practising in his native town (Abbeokuta), about sixty miles north of Lagos, in the Bight of Benin." The silk is found suspended to twigs in large masses, as large as a man's double-fist, and each comprising several hundred cocoons. It must therefore be carded like wool. A careful examination of the materials before him have led Mr. Westwood to conclude that the perfect insect is a moth smaller than that of the common silkworm, that it has wings striped with a dark colour, and that there is but very little difference externally to be perceived between the males and females; but until he obtain more perfect specimens, he cannot predict the family of moths to which this species belongs.

NATURAL HISTORY PHOTOGRAPHS.

Dr. Lankester has communicated to the British Association a paper "On Photographic Plates and Illustrations of Microscopic Objects in Natural History." The object of the author was, to draw attention to Photography as a means of procuring accurate copies of

objects of natural history,—more especially of those only seen by the microscope. The disadvantage of drawings in natural history was, that they more often represented the views of the author than correct delineations of the object. This was so much the case with drawings of microscopic objects, that the representations of different observers of the same thing could hardly be recognised as similar.

SLEEP OF PLANTS IN THE ARCTIC REGIONS.

MR. SEEMANN, the naturalist of Kellett's Arctic expedition, states a curious fact respecting the condition of the vegetable world during the long day of the arctic summer. Although the sun never sets whilst it lasts, plants make no mistake about the time when, if it be not night, it ought to be, but regularly as the evening hours approach, and when a midnight sun is several degrees above the horizon, droop their leaves and sleep even as they do at sunset in more favoured climes. "If man," observes Mr. Seemann, "should ever reach the pole and be undecided which way to turn, when his compass has become sluggish, his timepiece out of order, the plants which he may happen to meet will shew him the way ; their sleeping leaves tell him that midnight is at hand, and that at that time the sun is standing in the north."—*American Annual of Scientific Discovery.*

GIGANTIC TREE IN CALIFORNIA.

THE *Gardener's Chronicle* announces the discovery, in California, of a most magnificent coniferous tree, 300 feet high, which, from its extraordinary height and large dimensions, may be termed the monarch of the Californian forest. It inhabits a solitary district on the elevated slopes of the Sierra Nevada, near the head water of the Stanislau and San Antonio rivers, in lat. 38° N., long. 120° 10′ W., at an elevation of 5000 feet from the level of the sea. From eighty to ninety trees exist, all within the circuit of a mile, and these varying from 250 feet to 320 feet in height, and from 10 to 20 feet in diameter. Their manner of growth is much like Sequoi (taxodium sempervirens); some are solitary, some are in pairs; while some, and not unfrequently, stand three and four together. A tree recently felled measured about 300 feet in length, with a diameter, including bark, 29 feet 2 inches, at 5 feet from the ground; at 18 feet from the ground it was 14 feet 6 inches through; at 100 feet from the ground, 14 feet; and at 200 from the ground, 5 feet 5 inches. The bark is of a pale cinnamon brown, and from 12 to 15 inches in thickness. The branchlets are round, somewhat pendant, and resembling a cypress or juniper. The leaves are pale grass-green. Those of the young trees are spreading, with a sharp acuminate point. The cones are about 2½ inches long, and 2 inches across the thickest part. The trunk of the tree in question was perfectly solid, from the sap-wood to the centre; and, judging from the number of concentric rings, its age has been estimated at 3000 years. The wood is light, soft, and of a reddish colour, like red-wood or taxodium sempervirens. Of this vegetable monster, 21 feet of the bark, from the lower part of the trunk, have been put in the

natural form in San Francisco, for exhibition: it there forms a spacious carpeted room, and contains a piano, with seats for forty persons. On one occasion 140 children were admitted without inconvenience. An exact representation of this tree, drawn on the spot, has been lithographed. What a tree is this! of what a portentous aspect and almost fabulous antiquity! They say that the specimen felled at the junction of the Stanislau and San Antonio was above 3000 years old—that is to say, it must have been a little plant when Sampson was slaying the Philistines, or Paris running away with Helen, or Æneas carrying off good *pater Anchises* upon his filial shoulders. And this may very well be true, if it does not grow above two inches in diameter in twenty years, which we believe to be the fact. At all events we have obtained the plant. The seed received by Messrs. Veitch, King's-road, Chelsea, has all the appearance of vitality; and since the tree is hardy and evergreen, it is a prodigious acquisition.

THE DEODORA PINE-TREE.

An interesting Report has recently been published, addressed to the Right Hon. T. F. Kennedy, Commissioner of Woods and Forests, by Dr. J. F. Royle, late superintendent of the East India Company's botanical garden, Saharunpore, on the introduction and cultivation of the Deodora (the most valuable of the pine trees of the Himalayan mountains) in Great Britain. This tree is indigenous to the Himalayas from elevations of 5500 up to 12,000 feet above the sea, and is of a very hardy nature; growing on the tops of ridges and at the head of gorges, where it is exposed to great vicissitudes of temperature and violent gusts of wind: it flourishes also in the poorest soils. The deodora is represented in this report to be most valuable as a timber-tree. A group in the neighbourhood of Simla measured on an average 10 feet in girth, and another group nearly 11 feet, taken at five feet from the ground; while on the northern declivity of the Himalayas they have been measured from 20 to 30 feet in girth at the same height from the soil. The timber is stated to be most excellent in quality, being sufficiently close in texture to be made into articles of furniture, and is of great strength and durability. It requires little or no seasoning, and takes the saw kindly, though it will not split into planks. The deodora is said to be preferred by the natives of the Himalayas for the construction of houses, temples, and bridges, and is used not only under cover, but for the verandahs, roofs, and external framework of houses, and for the piers of bridges. It is considered almost imperishable, and peculiarly exempt from the attack of worms and insects; its only defect for building purposes arises from its extremely inflammable nature. The deodora is, however, owing to its strength and durability, admirably adapted for naval and architectural purposes, and it is said that a boat built of this wood will last from 20 to 30 years. There seems, therefore, no doubt of the deodora being fit for all the uses to which any of the pine-tribe are applied in Europe. So early as 1819 attempts were made to introduce the deodora into

this country, but they do not appear to have been successful until 1831, when the Hon. L. Melville brought over some seeds, from which most of the larger deodoras in Great Britain, from 20 to 25 feet, may be traced. The deodora, which used to be one of the dearest, is now one of the cheapest of the recently introduced foreign pine trees; the price having formerly been a guinea a plant, while they can now be had for 6*d.* each. It is stated that there are few parts of the British Isles where the deodora will not succeed, as it already flourishes as far north as Forres.—*Times.*

THE SOAP PLANT.

THE Vienna journals announce that a firm of California has sent home to that city some seeds of the soap plant. It grows wild in California, rising to the height of about a foot. The plant fades away in the month of May, and inside each is a ball of natural soap, superior, it is asserted, to any that can be manufactured.

INSTANTANEOUS FLOWERING OF PLANTS.

MR. HERBERT has exhibited at Onslow-house, Brompton, his method of causing plants to blow almost instantaneously. The plants selected—a group of geraniums and a rose tree—were planted in two rather deep boxes of garden mould, previously prepared with some chemical manure, and were then covered with glass shades. Mr. Herbert next proceeded to pour over the roots, from a small watering-pot, a chemical mixture, which uniting with the ingredients already in the earth, caused a great heat, as was shown by an intense steam of vapour, which was evolved within the shades, and allowed to some extent to escape through a small hole in the top, which at first was kept closed. The effect upon the geraniums was certainly almost instantaneous, the buds beginning to burst in about five or six minutes, and the plants being in full bloom within ten minutes, when the blossoms were gathered by Mr. Herbert, and distributed amongst the ladies present. With the rose-tree the exhibitor was less fortunate, Mr. Herbert explaining that it had only been in his possession about half or three-quarters of an hour, and he had therefore not had sufficient time to prepare for the experiment, thereby evincing that it occupies more time than would appear to the casual observer to be the case.

Geology.

ON SOME NEW POINTS IN BRITISH GEOLOGY.

PROFESSOR E. FORBES, President of the Geological Society, has read to the Royal Institution, a paper of new results and new interpretations of the Geology of the Isle of Wight, the bay of Whitecliff proving to be a rich source of novel geological information; and a great portion of the Isle of Wight, on further examination, turning out to belong to a division of the older tertiaries that had never been demonstrated to exist within the British islands. For the details see the *Philosophical Magazine*, No 39. We quote Professor Forbes's conclusion:—

The peculiar undulatory contour of the surface of the fluvio-marine portion of the Isle of Wight, is due to the gentle rolling of the beds in two directions, one parallel with the strata of the chalk ridge, and the other at right angles to it. The valleys and hills running northwards to the sea depend upon the synclinal and anticlinal curves of the latter system of rolls, a fact hitherto unnoticed, and the non-recognition of which has probably been one cause of the erroneous interpretation of the structure of the Isle of Wight, hitherto received. The truncations of these curves along the coast of the Solent exhibit at intervals beautiful and much neglected sections, well worthy of careful study. There is one of these sections near Osborne. Her Majesty's residence stands upon a geological formation hitherto unrecognised in Britain. Near West Cowes there are several fine sections along the shore. The total thickness of unclassified strata in the Isle of Wight is 400 feet if not more, and within this range are at least two distinct sets of organic remains. The fluvio-marine beds in all, including the Headon series, are very nearly 600 feet thick.

SINGULAR GEOLOGICAL FACT.

AT Modena, in Italy, within a circle of four miles around the city, whenever the earth is dug and the workmen arrive at a distance of 63 feet, they come to a bed of chalk, which they bore with an auger, five feet deep. They then withdraw from the pit before the auger is removed, and upon its being drawn out, the water bursts up with violence, and quickly fills the well thus made—the supply of water being neither affected by rains nor droughts. At the depth of fourteen feet are found the ruins of an ancient city, houses, paved streets, and mason work. Below this again is a layer of earth; and at twenty-six feet walnut trees are found entire, with leaves and walnuts upon them. At twenty-eight feet, soft chalk is found, and below this are vegetables and trees.

COAL IN GERMANY.

AT the late Meeting of the German Association for the Advancement of Science, held at Tubingen, Professor Karnat announced that Germany had Coal enough to supply herself and all the rest of the world for the next 500 years.

GEOLOGY OF THE INTERIOR OF AUSTRALIA.

MR. J. CALVERT has communicated to the British Association, "Some Observations on the Interior of the Australian Continent."

The writer stated his belief that as there was a great range of hills on the eastern side of Australia, there must also be another great granitic range on the N.W. He had made an expedition into the interior, which he had ascertained to consist of great salt plains considerably depressed below the level of the sea. In the S.E. of Australia he had observed two sets of boulders: one series, derived from distant snowy ranges, consisted of hard masses of granite, with scratched surfaces, were dispersed over the plains to the south-east; the other set consisted of masses, not transported, but bouldered by the action of the weather, which caused large hemispherical layers to shell off, some of them capable of holding water.

THE COAL FIELDS OF AUSTRALIA.

An important Report has been made from the Government geologist (Mr. Stuchbury) to the Colonial Secretary, which contains some valuable information as to a new coal-field he had met with on the Talbragar river. "The existence of beds of coal" (he observes) "so far west, cannot be deemed otherwise than very important, taking into consideration the development of the interior by steam communication, which will undoubtedly sooner or later be ramifying itself throughout the country by a network of railways. We have seen evidence of coal along the line of the Cudgegong; first near Mudgee, at Cloudy Bay, at Guntewang, near Cobbera, on the Talbragar itself, near Gillis' station; and, from the immense extent of the sandstone formation, it may fairly be presumed that it might be obtained, by sinking shafts, as far north as the Castlereagh River, west to Dubbo, south to near Madgee, and east to Belaro. Independent of the large area north of the Castlereagh, it is highly probable that the whole extent of country coloured as sandstone will be found to contain coal, with a few exceptions, in such instances as where the granites, trap, and other igneous rocks have intruded themselves, or where the sandstone but thinly covers the schistose rocks.

"Upon a second visit to Mangullia (Rhodes's) another and much thicker stratum of coal than that previously described, was observed, probably several feet thick.

"In the neighbourhood of the Macquarie Gap, although I did not succeed in finding coal, there can be no doubt of its occurrence below, as I found several very beautiful fossil plants in the argillaceous shales, which are invariably superimposed upon coal seams."

In a creek, Mr. Stuchbury found beds of nearly pure magnesia, from five to six feet thick. If this should prove to be of commercial value, it might be obtained in almost unlimited quantities. The area of this coal-field cannot be less than 16,000 square miles; much of this, of course, is seated at too great a depth for profitable working, but at Newcastle and the banks of the Hunter river, it crosses out to the surface in seams of from four to ten feet in thickness, with intermediate beds of conglomerate, requiring neither the making of shafts nor the erection of steam-engines. Commencing in the county of Durham, about 150 miles north of Sydney, the coal extends to the precipitous valleys of the Blue Mountains, which here traverse the

interior at a distance of about 60 miles from the coast; proceeding southward, the seam extends to Berrima, a small town on the Illawara river, about 75 or 80 miles south of Sydney. As a steam coal, it has been found, on analysis by Sir H. de la Beche, to be identical with the Hurworth Wall's End.

GOLD-FIELDS OF VICTORIA, OR PORT PHILLIP.

THE following paper has been communicated to the Geological Society by Mr. G. H. Wathen. The "Australian Alps" are a series of mountain ranges, that pass round the south-eastern corner of Australia (nearly parallel to the coast-line, and from 50 to 80 miles from the sea), and form a part of the main chain of the Continent. This mountain chain, in Victoria, consists of clay-slates, mica-slates, and flinty slates, together with granite, in a successional arrangement, forming collectively a recurring series. The strata are all nearly or quite vertical, with a north and south strike; and are intersected by numerous quartz veins, running at an acute angle with the slate. Vast plains of trap, forming high table-lands, run up to the base of the mountains, and probably cover their lower slopes. It is in the valleys and gullies of these mountains, and not very far from their junction with the trappean plains, that the rich deposits of gold are found. Gold has been discovered at several points along this zone of mountains; but the richest deposits opened in the colony of Victoria (and indeed in the whole continent) are those of Ballarat and Mount Alexander. The former is about 55 miles N.W. of Geelong; and the latter, about 75 miles N.W. of Melbourne. The enormous amount of gold which the latter district has yielded has been derived chiefly from two valleys, with their gullies and ravines. These valleys are known by the names of the streams or "creeks" that run through them. One of these, Forest Creek, takes its rise in the granite forming the central mass of Mount Alexander; the other has its source in the high and broken ranges of slate that environ the Mount. Both creeks are tributaries of the river Loddon, on the banks of which, also, gold is found in small quantities. The Ballarat gold-field lies at the junction of the slate, with a trappean tract, about seven miles from an extinct volcano, known as Mount Beninyong.

The original matrix of the gold seems to be the above-mentioned quartz veins, that traverse the slates generally in a north and south direction. The wearing away of the slate rocks and their quartz veins, by the action of the weather and by aqueous agency, has given rise to the auriferous beds of gravel and clay occupying the beds of the ravines and valleys at the present day. Occasionally the gold is found at or near the surface of the soil, diffused through the gravel. Sometimes it lies as much as 30 feet beneath the surface, embedded in clay, either immediately upon the rough rock surface below, or just above a white clay known by the miners as "the pipe-clay;" and it may be met with in other localities at every intermediate depth. In some places, boulders of quartz and beds of hard concrete of quartz and slate pebbles, occur in the auriferous clays. These different conditions of the auriferous beds depend upon the physical

characters of the gullies and the valleys down which the drifted materials have been carried, and upon the varying force of the water-power that at different times and at different places has been brought to bear upon this shingle, sand, and mud. Thus, in the creeks, the deposits in their channels are richest at points where the stream has been impeded in its course, either by frequent sinuosities or by being crossed by a bar of rock: this holds good with the deserted channels of streams also. When auriferous clays and gravels occur in the dry gullies descending from the higher ranges, the richest deposits are always found in the ancient channel or bed of the gulley, often occupying a very narrow area; but where these gullies contract at their junction with the larger valleys, the auriferous clays are often continued up the sides of the enclosing hills, even to their crests; and the distribution of the beds and of the gold is very variable under these circumstances, as though the beds had been here deposited by means of strong conflicting eddies and currents. It appears, that with regard to Victoria, the gold has been arrested in the small mountain ravines and gullies, and was not washed down to the larger streams. Auriferous sands in river banks, or in alluvial plains of the low lands, are unknown in this colony. The methods of working the gold-bearing alluvia, either at the surface or by pits and "holes," vary, of course, according to the depth to be attained, and the means at the command of the miners. The methods of separating the gold from the gravels and clays are the same as those used elsewhere in New South Wales and California. [Besides the Ballarat and Mount Alexander Gold Fields, "diggings" have been opened at Mount Blackwood, and on the Moorabool River, near Ballarat; on the Plenty and the Yarra Yarra Rivers, N.E. of Melbourne; on the Mitta Mitta River and Lake Omeo, in the N.E. part of the colony; as well as at several points along the eastern portion of the boundary line between Victoria and New South Wales.]—*Athenæum*, No. 1321.

NATIVE METALLIC IRON.

Dr. Andrews, in an examination into the minute structure of basalt, has found evidence of the existence of Iron in a native state. After pulverizing the rock, and separating with a magnet, the grains that were attracted by it, he subjected these grains, which were mostly magnetic iron, to the action of an acid solution of sulphate of copper in the field of a miscroscope.

This salt produces no change with the oxide; but if a trace of pure iron be present, copper is deposited. In his trials, there were occasional deposits of copper in crystalline bunches; the largest of which obtained was little more than one-fiftieth of an inch in diameter. He observes, that with 100 grains of the rock, three or four deposits of copper can usually be obtained. The basalt of the Giant's Causeway affords this evidence of the presence of native iron, but less so than the Slievemish basalt.

The same result would be produced if the nickel or cobalt were present in fine grains; but Dr. Andrews considers this very improbable. The same basalt afforded, on microscopic examination, augite, mag-

netic iron, pyrites, and a colourless glassy mineral.—*American Journal of Science and Arts*, No. 45.

DISCOVERY OF TIN IN VICTORIA.

Mr. J. M. Stephen, Vice-President of the Geological Society of Victoria, in examining several mineralogical specimens from the Ovens, has discovered Oxide of Tin in quadrangular crystals, with pyramidal terminations, being the common form of that valuable ore of tin. As the discovery of this metal in Victoria must prove of vast importance to the colonists, being stated to be in great abundance, Mr. Stephen has taken pains to prove by every known test, that not only the red crystals, but also the black fragments, or black sand, as the superficial observer would describe it, are the most valuable tin ore known.

"First, (says Mr. Stephen) I have fused one of the grains of the black fragments, with the blow-pipe in charcoal, which is a difficult operation with this ore, using the two fluxes of borax and carbonate of soda; and I have extracted a globule of pure tin from that grain (flattened with the pliers when cooling), together with the scoria attached to it—the most indisputable test. Secondly, I have tried in vain to dissolve it in either of the acids, which is another proof of its being oxide of tin. Thirdly, I have proved by weighing it in the hydrostatic balance, that its specific gravity agrees with that assigned to it by Professors Phillips and Dana (about 6.5, or six and-a-half times as heavy as water), being nearly double that of the spinal ruby; and, by Mohs' scale of hardness, that it is not so hard as that gem. Lastly, by its crystal (a four-sided rectangular prism, terminated by pyramidal planes), fracture, colour, and streak, and the condition under which it is found at the Ovens, associated with grains of gold and tourmaline, &c., and which agrees with that of Cornwall, that it is stream tin, or *débris* of tin veins, which is separated from the gravel by washing, as the name imports; and in all probability tin lodes will be found in the neighbourhood.

"I heartily congratulate our fellow-colonists that this valuable metal, so long sought for by experienced Cornish miners in South Australia, has at length been found in the colony of Victoria in such apparent abundance, presenting another profitable field for the employment of the surplus population and capital of the mother country." —*Australian and New Zealand Gazette.*

GOLD IN THE BRITISH ISLANDS.

Mr. J. Calvert, in a paper read to the British Association, states, from his own exploration, from researches in various works, and from communications, Gold was found in forty counties in these islands, and over an area of 50,000 square miles. He thus classified the gold regions:—The West of England, North Welsh, Mid-England, Northumbrian, Lowland, Highland, Ulster, and Leinster. The West of England region might be divided into three districts—Cornwall, Dartmoor and Exmouth, or West Somerset. In Cornwall, the tin-streams, which were of the same composition as gold diggings, had

long been known to contain nuggets and coarse dust, or hops of gold, but had only been slightly worked by Sir Christopher Hawkins, at Ladoch. The largest Cornish nugget was not worth more than about ten guineas. The Cornish districts were very rich in gold. The Dartmoor district contained gold in its northern and southern streams. A miner, named Wellington, got about 40*l.* worth of gold, at Sheepston, and Mr. Calvert had obtained gold from the granite by this process. In the West Somerset were four companies for working gold ores. From fifty-five tons of Poltimore ores, one hundred and two ounces of gold were lately reduced, being at the rate of sixteen pennyweights per ton, or twice the rate of the St. John del Rey ores. The West Somerset district probably embraced gold sites at Combe Martin and the Mendips. The North Wales district might embrace all the western counties of the principality. There were no reported river deposits, but gold ores had been worked at Carnhusian, Isso, Berthllwyd, Dolfrwynos, and other places. The Northumbrian regions embraced Alstone Moor; but the chief known gold-field was in Westmoreland and Cumberland. In the Goldscoop mine gold had been found in the copper for ages, and he (Mr. Calvert) had discovered it in many of the ores and rivers of the district. He showed specimens from High Treby, Caldbeck Fells, the Buttermere and Crumwick-road, Borrowdale, Buttermere, Bassenthwaite, and a fine lump of gold gossan, which weighed originally fifty-seven ounces. The south of Scotland district had only been worked for its river deposits in Clydesdale and Nithsdale, but in his (the lecturer's) opinion it extended throughout the lowlands. Gold was found in above forty brooks or gullies, and all of the miners have gold for sale, obtained in their holiday excursions.

Mr. Calvert mentioned that in the manuscripts of Queen Elizabeth's time the diggers relied on keele, a reddish earth, as an indication of gold, and the miners do so now. He had seen it also in Westmoreland, and had recognised it also in Australia and elsewhere. He found gold in the Lowther Burn, Long and Short Cleuch Burns, Mannock Water, Keppel Burn, Glengomar, Elvanwater, Goldscour, and other places. At Wenlockhead he saw gold in the midst of the town. At one place the miners, two years ago, got gold, which at Glasgow they sold for 42*l.* Gold was reported in Perthshire, Fifeshire, Stirlingshire, and Linlithgowshire. The Highland gold regions were unexamined. Gold localities had been reported in Aberdeenshire and Sutherlandshire. The Wicklow diggings were only shortly referred to. It appeared by returns obtained from the Dublin goldsmiths, that the present supply of the peasantry was about 2000*l.* a-year. In Ulster the peasantry work the aura of gold mountains in Antrimshire, and the Mayola streams in Londonderry yielded gold. The yearly produce of gold in these islands was now about 5000*l.* a-year, which might be largely increased. The number of gold bearing streams known was one hundred. Gold had been found in nearly all the clay-slate districts. Many of these were worked in the Middle Ages, and probably also by the Romans. Gold, in ores, was found associated with silver, lead, copper, iron, and zinc; with quartz,

granite, slate, oxide of iron, sulphate of iron. These ores have only been worked of late in Devonshire and Merionethshire. The river deposits were rudely worked by the miners or peasantry in Wicklow, Lanarkshire, Antrimshire, and Devonshire. The washing of gold-stuff in our home districts was very rude, and not equal to that in Australia, nor had there been for a long time any deep workings. Many rich gold ores were thrown away, and much metal was produced from which the gold was not refined. The only two gold-fields which had yet been worked had yielded considerable amounts: the Lanarkshire district from a quarter of a million to half a million, the Wicklow above 100,000*l*. The largest known nuggets were three pounds from Lanarkshire, and others of two pounds and a half from there and Wicklow. The importance of attending to this branch of the national resources was strongly urged. Mr. Calvert concluded by stating, that he considered the clay-slate formations of Canada would soon be discovered to be a vast gold-field.—*Athenæum*, No. 1351.

THE EXTINCT GENUS NESODON.

Professor Owen has read to the Royal Society, a "Description of some species of the extinct genus *Nesodon*." The author commences by referring to a genus of extinct herbivorous mammals which he had founded in 1836, on certain fossil remains discovered in Patagonia; and which, from the insular disposition of the enamel folds characteristic of the molar teeth, he had called *Nesodon*. Subseqent transmissions of fossils from the same part of South America, by their discoverer, Capt. Sulivan, R.N., now enabled the author to define four species of the genus.

The structure of the grinding teeth proving the extinct animal to have been herbivorous; the number and kinds of teeth in the entire series show that it was ungulate. In this great natural series of mammalia the author next shows that the *Nesodon* had the nearest affinities to the odd-toed or Perissodactyle order amongst the existing species; but certain modifications of structure, hitherto peculiar to the even-toed or Artiodactyle Ungulates, are repeated in the cranium of the *Nesodon:* more important marks of affinity are pointed out in the *Nesodon* to the *Toxodon;* and both these extinct forms of South American herbivores are shown to agree with each other in characters of greater value, derived from the osseous and dental systems, than any of those by which the *Nesodon* resembles either the Perissodactyle or Artiodactyle divisions of hoofed animals.

Of the genus the author defines four species:—The first, about the size of a Lama, is the *Nesodon imbricatus;* the second, of the size of a Zebra, is the *Nesodon Sulivani;* the species to which belong the portions of skull, with the teeth, described in the present memoir, did not exceed the size of a large sheep, and is termed the *Nesodon ovinus;* fourthly, a species of the size of a Rhinoceros, *Nesodon magnus,* is satisfactorily indicated by a grinder of the upper jaw. In conclusion, the author remarks, that the osteological characters defining the orders of hoofed quadrupeds, called *Proboscidia, Perisso-*

dactyla, and *Artiodactyla*, are associated with modifications of the soft parts of such importance, as not only to establish the principle of that ternary division of the great natural group of *Ungulata*, but to indicate that the known modifications of the skeleton of the extinct Toxodons and Nesodons of South America, in the degree in which they differ from the osteology of the already defined orders of *Ungulata*, must have been associated with concomitant modifications of other parts of their structure which would lead to their being placed in a distinct division, equal to the *Proboscidia;* and, like that order, to be more nearly allied to the *Perissodactyla* than the *Artiodactyla*. This new division of the *Ungulata* the author proposes to call *Toxodontia;* and he remarks that its dental and osteal characters, while they illustrate the close mutual affinities between the Nesodons and Toxodons, tend to dissipate much of the obscurity supposed to involve the true affinities of the *Toxodon*, and to reconcile the conflicting opinions as to the proper position of that genus in the mammalian class. For the dental and osteal characters, see the Report in the Proceedings of the Royal Society.

NEW PLESIOSAURUS IN THE YORK MUSEUM.

PROFESSOR PHILLIPS has stated to the British Association :—it was a curious circumstance that each of the three great Plesiosauri lately discovered in Yorkshire belonged to distinct and undescribed species. One of these, described by Mr. Charlesworth at a former meeting, was now in the possession of Sir P. Crampton, in Ireland ; the other two were in the York Museum. One of them was eighteen feet long, and had a very small head ; the other was equal in size to the largest Plesiosaurus of the Kimmeridge clay. Its head is forty-two inches long, and much narrower in proportion than in the other species ; the neck is much shorter, being only half as long, in proportion, as in the *P. dolichodeirus*. The paddles are five feet in length. The vertebræ are like those of the other species ; the teeth slightly different. It was found in Lord Zetland's works, at Lofthouse, on the Yorkshire coast.

BONES AND TEETH IN OXON.

DR. DAUBENY has read to the Ashmolean Society, some remarks on a collection of Bones and Teeth lately found while excavating a piece of ground for the branch railroad, near the village of Yarnton, Oxon. In the surface soil, many human bones, as well as those of horses, were found buried ; probably they were the remains either of the army of the Royalists or of the Commonwealth, who were slain in a skirmish, as it was known that the armies had encamped in that neighbourhood. A curious phenomenon is connected with this spot : on the blue clay below the bed of gravel, which is from twelve to eighteen feet in depth, a large number of the remains of elephants, and also extinct animals, were found. In the space of about an acre, upwards of fifty elephants' teeth were found ; many of them as perfect as when they were in a living state, not having the slightest appear-

ance of being rubbed, or transported to the spot. The bones seemed to have decayed altogether; and the remains of the tusks, which have been found, are reduced to a chalky state similar to the ivories from Nineveh, lately sent to the British Museum, and which have been so curiously restored by being boiled in gelatine.—*Morning Chronicle.* (We notice, with pleasure, that the proceedings of scientific societies are very ably reported in this journal).

FOSSIL HUMAN TEETH.

THE great fact elicited at the late meeting of the German Association at Tubingen, was the clearing up of the mystery of the Fossil Human Teeth found in the Swabian Alps, in strata of the mammoth period; and doubts expressed as to their being human teeth, as man was not believed to have existed in the time of the mammoth. Since the meeting of 1852, a number of perfect human skulls have been found in the same locality, with teeth in them; which discovery, if correctly reported, would naturally lead to the conclusion that a race of human beings was in existence contemporaneously with the mastodon, and other of the larger antediluvian animals.

VOLCANIC ERUPTION IN THE CRIMEA.

THE *Gazette* of the Academy of St. Petersburg publishes the Report of a M. Begitschef, a Russian *savant*, who states that while crossing over the Strait of Taman, from Kirch, with some workmen, early in the morning of the 6th August, they saw a flame, accompanied by a thick vapour, rising from the summit of the mountain of Korabetoff, situated about four versts (three English miles) from the town of Taman. The sky was clear, and the temperature mild at the time. In a few minutes, the column of fire and smoke had reached a great height, and remained in that state for five or six minutes. Two other eruptions followed at short intervals, but with less violence than the first. This volcano had remained tranquil for at least thirty-five years. Immediately on landing, M. Begitschef and his men proceeded towards the mountain, which they reached at ten o'clock. At about 700 yards from the foot of it, they found a mass of black mud spread on the ground to a considerable depth, which had been thrown out by the eruption. The crater made a whistling noise, similar to that made by an engine when letting off its steam, and which at times became so violent as to somewhat alarm the party. The ground was cracked in different directions, and round the fissures the grass appeared perfectly calcined, and in several parts had caught fire. The eruptions lasted altogether about three hours.

EARTHQUAKES IN 1853.

THE record of the past year is strangely scarred with terrific phenomena of this class, many of which have been attended with appalling loss of life.

Brighton.—On the same night, April 1, two persons who were in bed, at a house in the King's Road, felt a tremour which made one of them instantly believe that an earthquake had occurred. The

time was noted, and was 10 minutes to 11 o'clock. The tremour was repeated once, if not twice. The motion which they felt was due to the earthquake which at the same time was sensible at Coutances, Havre, Caen, &c.

Jersey.—On the same night, January 1, a severe shock was felt in this island, commencing about 15 minutes before 11, and lasting about 20 seconds. The oscillation was from N.E. to S.W., and was attended by a subterraneous noise, resembling that of an artillery waggon rolling quickly over a newly macadamized road. The night was clear, with a light breeze from the N.W.; but heavy rain subsequently fell, and the wind considerably increased. The shock was very sensibly felt in Guernsey, and by vessels in the English Channel.

Upper Canada.—Earthquake shocks, although not unknown in Upper Canada, are of sufficiently rare occurrence to show an unusual range, or an unusual direction, in the movement of the earth's crust which occasions them, when they are perceived in this neighbourhood. The recollection is still preserved of a pretty strong shock that was felt at Niagara in 1801 or 1802; and it is the first conclusion of Robert Mallet, from his elaborate examination into the facts of earthquake phenomena, (Reports British Assoc., 1850,) that "Earthquakes occur over all parts of the earth's surface, both on land, and under the water;" he even goes further, and affirms that there is, at present, no sufficient ground for asserting that one region of the globe is permanently subject to them more than another. The great Lisbon earthquake of November, 1755, furnishes, however, the only example which we find in his list, of a shock reported from the lake districts of Canada. They are more common in Lower Canada. A shock which occasioned considerable alarm, and even some damage to buildings, at Nicolet, and on the shores of Lake St. Peter, on the 18th January, 1843. There was another at Montreal and its vicinity in April, 1843. Shocks were observed at Rochester, N. Y., September 19, and October 22, 1844 (R. R.) On November 2, 1850, a little before midnight, a shock, accompanied by a rumbling noise, was perceived at Frederickton, N. B. These instances, which are not given as a complete list, show that Upper Canada is less removed from the region of this phenomenon than is commonly supposed by Canadians. On the 13th March, 1853, a shock was felt in the Niagara district, and also perceived at Toronto. "About half-past 5 o'clock, A.M.," writes one observer, "I was startled by a strange rumbling noise: it produced the usual effect of thunder that is near, namely, a trembling of the house and bed, and a shaking of the windows; the first impression made upon me was that it was thunder, but I could not help feeling at the time that there was something strange and unusual in the effect produced, and the second impression was that it closely resembled what I had frequently read of earthquakes." A second observer, residing in a different part of the city, places the time earlier. "About ten minutes before five o'clock, by my watch, I was awakened out of a sound sleep by a rumbling noise, which I distinctly heard for some seconds after I awoke.

Mrs. —— who was awake previous to the shock, not only heard the rumbling, but felt the bed vibrate to and fro."

The barometer was falling a little at the time of this occurrence, but its depression was only—.085 at 2 P.M., and at the next observation it had risen; the thermometer was above the mean, a very marked depression of temperature however followed it, giving the lowest of the month,—0.°2 Fahr., on the night of the 14th instant. A state of magnetic disturbance, of considerable activity, moderate in respect to the amount of the changes, prevailed throughout the 12th; but the photographic instruments at the Observatory showed that no particular change of declination accompanied the movement itself. A westerly movement of six seconds occurred from 5h. to 5h. 15m.—From *The Canadian Journal; or, Repository of Industry, Science, and Art,* published monthly at Toronto, for the Council of the Canadian Institute.

On Sunday (March 20) morning, about five o'clock, a heavy shock was felt, accompanied by a rumbling sound, as if hundreds of heavily laden waggons were passing the street; then followed three other shocks, which caused everything to tremble to its very centre. It was felt in the neighbourhood of Grimsby, Jordan, Thorold, the Falls, Queenston, and Niagara. At Fort Mississaugua everything reverberated with the crash.

Off Cape Egmont.—A letter from Mr. T. S. Ralph, A.L.S., to Mr. Kippist, Lib. L.S., and dated "Brig Marmion, on her passage (from Wellington, New Zealand) to Port Phillip," states:—"On the evening of Saturday last (1st of January, 1853), while off, some fifty miles west, of Cape Egmont, half-past eight P.M., we on board the brig experienced the horrible shock of an earthquake, which caused the vessel to shudder and shake just as if she had grounded on a shingle spit; and, indeed, so loud was the sound under us, and so great the agitation, that I took it at the time to be a case of wreck with us, and knowing the sea was running rather high, hardly expected to reach the deck before she might begin to break. The shock lasted about twenty seconds, during which I had only time to secure my watch and compass, and seek the deck, when the whole was explained, and I had the satisfaction of experiencing some eight others of diminished energy, during the succeeding forty minutes, the last of which I measured, and found it did not exceed seventeen seconds, and was about equal in duration to the first, which of course I could not ascertain very accurately, but by reference to the time occupied by succeeding ones."

Cumana, on the Spanish Main.—The 15th of July rose clear and unclouded, and until two o'clock an agreeable breeze blew from the sea; at that hour, the wind changed to the south, which was the only atmospheric variation observable. At a quarter-past two, the first shock was felt. This was thought to be but one of the slight tremblings of the earth to which the citizens were accustomed, and to bear which the houses are expressly built; but, in a few seconds after, an awful convulsion was felt, accompanied by frightful noise and deep darkness. The consternation was universal. Not a single

family escaped without cause to mourn the loss of some of its members. In the streets, squares, and neighbouring fields were seen wandering spectres, covered with blood and dust, and filled with terror. No less than 4000 were killed; and all the public buildings fell, and almost all the private houses were destroyed, whilst those which were not entirely ruined were so injured as to be uninhabitable. The river Manzanares, which flows through the town, rose several feet, and the bridge fell which connected the town on both sides. Several deep openings were formed, from whence rose boiling water. The ancient city of Cumana, the first built on *terra firma* by the Spaniards, has disappeared in an instant!

Persia.—A letter, dated the 14th of May, gives the following details of an earthquake at Schiras, on the 21st of April. The town of Schiras no longer exists, having been completely destroyed by an earthquake. All the inhabitants were asleep, from which they were awakened by a noise louder than that of thunder, and by a mass of stones falling into their rooms. The immensity of this disaster was only visible when daylight appeared. On every side, the eye could see nothing but a heap of ruins, streets blocked up with stones, and dead bodies being carried on litters without the walls of the town. Out of several thousand victims, the lives of a very small number were saved. These scenes were repeated for five days, during which it is calculated that 12,000 persons perished. For three days, the town was delivered up to the pillage of brigands. Shocks were felt three or four times a day, and were so violent that the houses which had resisted former shocks, fell to the ground one after the other.

Thebes.—On August 18th, the town of Thebes was entirely destroyed by an earthquake. A letter from Athens, dated August 26th, says: "Eleven persons lost their lives on this occasion. Eighteen wounded were dug out of the ruins. The town consisted partly of stone houses, which were all new, and partly of old houses constructed of wood and bricks. The former were completely destroyed, and the latter have become perfectly uninhabitable. The town of Thebes had plenty of water; but after the catastrophe, there was a great scarcity of this necessary element, and the fearful clouds of dust raised in columns by the crash of houses had lighted on the vineyards and orchards, and rendered much of the fruit uneatable. Besides, seventeen villages in the vicinity of Thebes, as far down as Platäa, suffered so much that they have become uninhabitable. Also in Chalkis, on the island, some houses were destroyed. The shocks continued both at Athens and at Thebes from the 18th to the 26th, so that from one to three shocks were felt within twenty-four hours."

Van Diemen's Land.—"At ten minutes before six, on the evening of Sept. 20, 1853," (says a correspondent of the *Hobart Town Advertiser,*) "we had a severe shock of an earthquake; the house, which is built of stone, shook severely. The tea-things were on the table at the time; the furniture, cups, &c., all danced. Mrs. Hobbs was sitting leaning against the side of the fireplace, my son William was by her leaning on the mantelpiece, his head resting on his hand. The shock was so severe to them both, they felt it long after. One of my

daughters was stooping at the time, and fell on her head; I can only compare it to the rolling of heavy waggons under an archway. All passed away to the north-east."

GREAT EARTHQUAKE IN THE INDIAN ARCHIPELAGO.

THE *Singapore Free Press* of 4th February last, quotes from the *Java Bode* the following details of a terrible commotion which commenced on the 16th, or probably on the 26th of November, and lasted until 22nd December, 1852.

On 16th November, about 20 minutes to 8 in the morning, a heavy vertical oscillation of the ground was felt at Banda Neira, which soon changed into a rapidly increasing undulation from the N.E. to the S.E., which lasted for more than five minutes. Every one left his house; to remain standing was impossible; people were obliged to take a firm hold of something, or throw themselves on the ground. In the morning, a slight shower of rain fell, but otherwise the weather was not unfavourable. At the first shock, nearly all the houses were thrown down or very much shattered. The Government buildings, the church, the officers' houses in the encampment, and the warehouses, suffered the greatest injury; the Chinese quarter was a heap of ruins—the native village on the Zonnegat was laid waste. The Papenberg fell partly in, and two bamboo houses upon it disappeared; and on Great Banda, the houses of the park-keepers, their out-houses and smoking-houses for the nutmegs, underwent the same fate; everything there was also thrown down or greatly injured. Nothing was visible of the village Lonthoir but a heap of ruins. Saru was terribly shattered, while detached pieces of rock lay everywhere scattered around. There were no deaths, however, to lament, and only some persons were slightly bruised or wounded. But the misfortune did not stop here. About eight o'clock, a disturbance of the sea (Zee-beving) occurred, which filled every heart with fear and dismay, and caused every one to fly to the highest ground. In quick succession the bay filled and emptied, and at times it appeared to be only a little river. The ship *Atia-al-Rachman*, laden with rice, lying in the roads, twice touched the ground, after—like her Majesty's brig, *De Haai*, which had anchored the day previous—having been driven backwards and forwards a number of times. But this seaquake increased in a frightful manner, and thrice overwhelmed Great Banda and Neira with the largest rollers; on the last place, they reached several feet high in the houses, and burst the doors open. These huge waves formed in the Zonnegat and in the channel of Lonthoir, and ran so high that they beat over Fort Nassau, and reached the foot of the hill on which Fort Belgica is built, carrying everything with them in their reflux, but at the same time leaving behind a quantity of fishes. The prahus in the road were driven amongst and against each other, and carried to and fro from the shore. They foundered or drove in the Zonnegat, where they struck on the shore.

"LONDON TURF."

A SINGULAR geological discovery has been made at Deptford, in Kent, four miles from the metropolis. Mr. Gwyume, the engineer, in preparing to erect one of his Balanced Centrifugal Pumps, at about half a mile from the banks of the Thames, his workmen, in commencing to sink through from London clay, came, at a depth of three feet from the surface, upon a bed of peat, apparently possessing every characteristic of peat-bogs in different parts of the country, and composed principally of vegetable *sphagnum*, the true peat-plant. Whether this should prove a bed resting on the chalk, or in a basin of the London clay again covered by that deposit, it gives rise to a question of singular import—how came a portion of geologically recent alluvial deposits beneath the upper stratum of the tertiary period? The experiments on this singular specimen of *London Turf* with Messrs. Gwyume & Co.'s machinery at Essex Wharf, Strand, in the preparation of peat have been highly successful.—*Abridged from the Mining Journal.*

SKIN OF THE ICHTHYOSAURUS.

MR. H. COLES, in cleaning some specimens of Ichthyosaurus obtained from the lias of Tewkesbury, had his attention drawn to the occurrence of a number of minute black points, which, on being submitted to microscopic examination, appeared as small, curved, hollow, spine-like bodies. In other specimens, Mr. Coles found a thin layer of these minute bodies massed together, and lying against the surface of different parts of the skeleton. The author draws the conclusion that these small seti-form bodies were an important element of the dermal covering of the ichthyosaur.

DR. OWEN'S DESCRIPTION OF A NEW MODE OF DRAWING FOSSILS.

THE fossil itself serves as a guide and model to work from. After the specimen is fixed permanently on the machine, one arm, pointed with steel, traverses all its inequalities of surface, in close, parallel, waving lines, and imparts a corresponding movement to a diamond point, in contact with the steel plate, which cuts similar lines through the prepared asphaltum surface down, and slightly into, the steel plate; subsequently these lines are corroded deeper—in the language of the engraver, bitten—into the metal by means of dilute nitric acid. Thus is produced an engraving, in a delicate, silvery effect of light and shadow; capable of giving, if desired, 100,000 impressions of as perfect a counterpart of the original as can be accomplished by the Daguerréotype process, provided the subject has not too great relief, and can be placed in a horizontal position in the machine.

REPTILIAN REMAINS.

THE following communication has been read to the Geological Society:—"Notice of the Discovery of Reptilian Remains and a Land Shell in an upright Fossil Tree in the Coal of Nova Scotia," by Sir C. Lyell and J. W. Dawson, Esq.—"Notes on these Reptilian Remains," by Prof. Wynam and Prof. Owen. In September last Sir

C. Lyell and Mr. Dawson revisited the strata of the coal formation at the South Joggins, Nova Scotia, with a view of ascertaining what may have been the particular circumstances which favour the preservation of so many fossil trees, at so many different levels, in an erect position (such a position being a rare and very exceptional fact in the coal strata of North America generally). They were also desirous of obtaining additional evidence with regard to the relation of the Stigmaria as a root to the Sigillaria;—and also directed special attention to the difference of the deposits enveloping the upright trees, and those that fill the trunks themselves. In examining the stony contents of these fossil trees, the remains of plants, such as Ferns, Flabellaria, Sigillaria, Calamites, and Stigmaria, were met with; and in one of the trees were found, near the base of the trunk, several small bones intermingled with fragments of carbonized wood. The whole were imbedded in a dark-coloured stony matrix, in breaking up which, besides the bones, was found a small shell, referable to the well-known group of land shells, Pupa and Clausilia; the osseous remains consist of the bones of the head and extremities, jaw, teeth, vertebra, and dermal plates of one or more small reptiles. These have been examined by Prof. J. Wynam, of Harvard University, and Prof. Owen, who pronounce them to have belonged to a Batrachian reptile allied to the Menobranchus and Menopome at present inhabiting the rivers and lakes of North America. These eminent comparative anatomists also point out that the fossil reptiles bear some interesting relations to the Labyrinthodontoid type of reptiles.

ON A BATRACHOID FOSSIL FROM THE COALSHALE OF CARLUKE, LANARKSHIRE, BY PROFESSOR OWEN.

THIS specimen was met with by Prof. M'Coy in the Museum of the Earl of Enniskillen, and consists of the right half of the facial part of the skull of a small reptile, closely allied to the Archegosaurus. The bones are slightly dislocated and squeezed into the shale, with their smooth inner surfaces exposed. With regard to the affinities of the Archegosaurus of the German coal-fields, observes the Professor, of which a large proportion of the skeleton has been obtained, "I retain the same opinion which I formed after becoming acquainted with the estimable work of Prof. Goldfuss, and after receiving from its author casts of the fossils therein described and figured, viz., that they were essentially Batrachian, and that the Archegosaurus is most nearly allied to the Perrennibranchiate, or lowest, or most fish-like of that order of reptiles. The evidence which Sir C. Lyell has obtained in corroboration of that afforded by foot-prints of the existence of reptilia in the coal formations of Nova Scotia leads also to a reference of these coal-field reptiles to the same low group in the air-breathing vertebrate classes. The fossil above described," continues Prof. Owen, "gives additional evidence to the same purport, and extends the known geographical range of the Batrachoid reptilia of the carboniferous epoch."

OOLITE OF LINCOLNSHIRE.

THERE have been read to the Geological Society, observations

"On some Sections through the Oolite District of Lincolnshire;" describing a series of sections exposed during the progress of the works of the Great Northern Railway between Peterborough and Grantham. These show some interesting phenomena connected with the boulder clay, and more especially some peculiar facts belonging to the relations and character of the lower beds of the oolite series in that district. The general observations tended to prove that considerable difference of character obtained in the Lincolnshire district as compared with the south-west of England, the true fuller's-earth being absent, and replaced by beds having conditions intermediate to and linked with those long ago described by Professor Phillips on the Yorkshire coast. Instead of the two separate oolite deposits, great oolite and inferior oolite (as developed in the Cotswolds), between the cornbrash and the ferruginous rock immediately overlying the upper lias shales, the Lincolnshire oolite consists of one mass only (as in Yorkshire), blending in its fossil contents the conditions of the two oolites of the south-west of England.

EXTENT OF GLACIERS IN THE POLAR REGIONS.

On every side of the Southern Pole, on every meridian of the great South Sea, the seaman meets icebergs. Not so in the north. In the 360 deg. of longitude, which intersects the parallel of 70 deg. north (about which parallel the coasts of America, Europe, and Asia, will be found to lie), icebergs are only found over an extent of some 50 deg. of longitude, and this is immediately in and about Greenland and Baffin's Bay. In fact, for 1375 miles of longitude we have icebergs, and then for 7635 geographical miles none are met with. This interesting fact is, in my opinion, most cheering, and points strongly to the possibility that no extensive land exists about our northern pole, —a supposition which is borne out by the fact, that the vast ice-fields off Spitzbergen show no symptoms of ever having been in contact with sand or gravel. Of course, the more firmly we can bring ourselves to believe in the existence of an ocean-road leading to Behring's Straits, the better heart we shall feel in searching the various tortuous channels, and different islands with which, doubtless, Franklin's route has been beset. It was not, therefore, without deep interest that I passed the boundary which nature had set in the west to the existence of icebergs, and endeavoured to form a correct idea of the cause of such a phenomenon.—*Osborne's Arctic Journal.*

GLACIAL SEA IN YORKSHIRE.

Professor Phillips states that in a comparatively modern geological period every part of Yorkshire below the level of 1500 feet was covered by the waters of a Glacial Sea. Icebergs appear to have floated over the whole of the Hull district, depositing, where they melted or overturned, the materials brought from the higher hills. Amongst these were blocks of stone from Cumberland and the West Riding, now found perched on the limestone hills. Some of them must have come over the Pass of Stainmoor, a height of 1440 feet.

Astronomical and Meteorological Phenomena.

ASTRONOMY OF THE YEAR 1853.

WE quote the following from a valuable contribution to the *Inverness Courier*, by Mr. Robert Grant, Secretary to the Royal Astronomical Society; and we perfectly agree with the Editor of the above journal, that Mr. Grant's paper gives a clear and connected view of the whole Astronomical Discoveries of the past year, at home and abroad; and which only a person in Mr. Grant's honourable position, and possessed of his talents and learning, could accomplish:—

ROTATION OF THE EARTH.

COMMENCING with the star which more especially concerns us, inasmuch as it forms the home of our present existence, we find some interesting facts, the establishment of which is due to the great German astronomer, M. Hansen, whose recently published labours have been honoured with the prize of the Academy of Sciences of Dantzic. His memoir contains a masterly investigation of all the circumstances which can affect the motion of a pendulum swinging about a fixed point. One result obtained by him, which had not previously been deduced from theory, is—that if the pendulum, which in such experiments usually consists of a spherical ball suspended by a thread or slender wire of metal, *should have a rotatory motion about its own axis*, the plane of oscillation will generally revolve from this cause with a velocity which may equal, or even exceed, the velocity depending directly on the diurnal rotation of the earth. Thus we find that a slight twisting of the thread of suspension, which it is exceedingly difficult to guard against, will suffice to vitiate completely this delicate experiment. Indeed, it is very doubtful if ever the experiment has been successfully performed in this country.—*Grant.*

SOLAR FACULÆ.

A SINGULAR appearance, observed during the totality of an eclipse, consists of a series of rose-coloured protuberances of different shapes and sizes, dotted irregularly around the margin of the dark disc of the moon. It has been a difficult matter to ascertain whether these objects belong to the sun or the moon, in consequence of the complete overlapping of the two bodies, combined with the circumstance of their apparent magnitudes being very nearly equal. It seems, however, to have been pretty satisfactorily established, by observations of the total eclipse of 1851, that they are in reality suspended in an atmosphere encompassing the body of the sun. Attempts have been made, but hitherto with imperfect success, to connect these protuberances with the spots usually seen on the sun's surface. M. Schweizer, a Russian astronomer, has lately advanced a new theory on the subject. He maintains that the protuberances are identical, not with the *spots* which are *darker* than the rest of the sun's surface, but with the *faculæ*, which consist of streaks and small patches

of light *brighter* than the other parts of the solar disc. He endeavours with considerable success, to support this view of the subject, by instituting a comparison between the observed positions of the protuberances during the total eclipse of 1851, and the actual positions of the *faculæ*, as seen on the sun's surface for several days before and after the eclipse. This interesting question, however, can be definitively resolved only by a careful observation of future eclipses.*—*Grant.*

THE LUNAR THEORY.

Mr. Adams, one of the independent discoverers of the planet Neptune, has recently detected an important error, which the great French geometer, Laplace, had committed in his investigation of what is termed the secular inequality of the moon's mean motion. This consists of a slow change of the moon's angular velocity round the earth, occasioned by the disturbing action of the planets, which in the first instance affects the earth's orbit, and is thence propagated by a reflective process to the moon. This is not the only part of the Lunar Theory which, during the past year, has been improved by the researches of Mr. Adams. The beautiful art of photography seems likely to be of much utility in conducting us to a more accurate knowledge of the physical constitution of the moon. At the annual visitation of the Royal Observatory of Greenwich, in the month of June last, much interest was excited by the exhibition of a photographic image of the moon in her first quarter, which had been taken with the great refracting telescope of the Cambridge Observatory, Massachusetts, U.S. At the meeting of the British Association, held at Hull in the month of September, Professor Phillips exhibited several interesting specimens of the same kind, taken with a telescope of eleven foot focal length.† With the magnificent reflecting telescope of Lord Rosse, it will be possible to obtain a photographic image of the moon, which, under a magnifying eye-glass, will exhibit the surface of that body as if it were viewed with the naked eye at the distance of twenty-four miles! Under such a condition an object of the size of an ordinary house would be distinctly visible. Steps have been taken by the British Association to procure the co-operation of a corps of observers in different countries, for the purpose of mapping out, by a photographic process, the whole of the moon's visible surface. By this means it is expected that much light will be thrown upon the geology of the moon, which, in its turn, may suggest some valuable conclusions relative to the kindred subject of terrestrial geology.—*Grant.*

PLANETOIDS.

Four new planets have been discovered during the past year, all

* M. Schweizer's paper on this subject has been communicated to the Astronomical Society, and is printed in their "Proceedings."

† Three important papers were read to the British Association, during the late meeting at Hull: 1. "Report of the Committee appointed at Belfast to inquire into the Physical Character of the Moon's Surface, as compared with that of the Earth," by Professor Phillips; 2. "On Photographs of the Moon," by Professor Phillips; 3. "On Drawings of the Moon," by J. Nasmyth. For these three papers, see the Proceedings of the Association, in the *Athenæum*, No. 1352.

belonging to the singular group of bodies revolving between the orbits of Mars and Jupiter. The number of these minute bodies, or Planetoids as they are termed, now amounts to twenty-seven. In all probability they are innumerable, and gradually dwindle down in magnitude to the size of mere fragmentary rocks. An interesting paper on the subject of the Planetoids has lately been communicated to the Institute of France, by M. Le Verrier. From the circumstance of these bodies being all included within a zone of limited dimensions, that eminent geometer is inclined to believe that we may ultimately arrive at some definite conclusions with respect to the law of their distribution. It is certain that the aggregate mass of all these bodies, notwithstanding their probably incalculable number, cannot be considerable, since they would otherwise exercise a sensible disturbance on the motions of the neighbouring planets, Mars and the Earth. M. Le Verrier has calculated that, if the aggregate mass of the planetoids were equal to the earth's mass, it would occasion a perturbation of the longitude of the perihelion of Mars amounting to eleven seconds of a space in century. Now, if the perturbation amounted even to one-fourth of this quantity, it could not fail to be detected by observation; and as no evidence of the existence of such a perturbation has been hitherto obtained by any astronomer, we are hence warranted in concluding that the aggregate mass of the planetoids does not amount to one-fourth of the earth's mass. As regards the inferior limit of the aggregate mass of these bodies, it is impossible to ascertain its value in the present stage of the inquiry. The calculation of the motions of the planetoids has proved very troublesome to the physical astronomer; for in consequence of the eccentricities and perihelia of their orbits being generally considerable, the usual method of investigating the perturbations of a planet is not applicable to these bodies. The method actually employed in calculating the perturbations of a planetoid has, indeed, been one of a very imperfect kind, and it has long been a great desideratum to discover some process of investigation more in accordance with the advanced state of astronomical science in other respects. This important object has, at length, in the course of the past year, been accomplished with complete success by the combined efforts of the two great German astronomers, MM. Hansen and Encke.—*Grant.*

THE PLANET SATURN

has engaged the attention of astronomers during the year that has just closed. This magnificent planet, with his stupendous triple ring, has formed a very imposing object when seen in a good telescope. In order to understand this rightly, it should be mentioned, that in the year 1848 the rings—which are all three in the same plane—were turned edgeways towards the earth; and, as they are excessively thin, they were consequently invisible, except in one or two very powerful telescopes, which showed them *as a very narrow black line* passing across the body of the planet. Since that time the rings, in consequence of the motion of the planet in its orbit, have been gradually opening out, so that now their annular

conformation is very readily perceived, the heavens being distinctly visible through the space which separates them from the body of the planet. A very striking fact has recently been established with respect to the physical constitution of the innermost ring, which, as our readers are aware, was discovered only two or three years ago. Captain Jacob, at Madras, and Mr. Lassell, during his late sojourn at Malta, have both independently remarked that the contour of the planet was distinctly visible through the substance of the ring at those parts where the latter appears to cross the body of the planet. This unequivocal evidence in favour of the transparency of the ring would seem to indicate that it is in reality composed of a fluid substance, a conclusion which, besides appearing very probable from *à priori* consideration, is strongly supported by the variable appearance which the rings have presented, when viewed from time to time in the telescopes of different observers.—*Grant.*

NEW COMETS.

FIVE Comets have been discovered during the course of the year 1853. The first of these, which was discovered by Signor Secchi at Rome, on the 6th of March, is probably identical with a Comet which appeared in the year 1664. If this be really the case, it follows that the comet revolves in an elliptic orbit, having a period of about one hundred and eighty-nine years. With respect to the other four comets, their orbits appear to be sensibly parabolic, whence we may conclude that neither of them will ever again visit the solar system. With respect to the physical aspect of these comets, by far the most remarkable was the third in the order of discovery, which was originally detected by M. Klinkerfues, at Göttingen, on the 10th of June, and which became generally visible to the naked eye towards the end of August. As the body approached the sun, a succession of jets of luminous matter was observed to emanate incessantly from the nucleus; first advancing a short distance towards the sun as if yielding to the attraction of that body, and then bending backwards, as if impelled by some prodigiously intense force in the opposite direction. It has been conjectured, with some show of probability, that this unknown force is attributable to the electricity developed by the solar heat. The great astronomer Bessel, who had studied with profound attention a similar phenomenon which manifested itself on the occasion of the apparation of Halley's comet in 1835, remarked that one more of such notable examples would vastly contribute towards a more satisfactory view of the hitherto mysterious subject of the physical constitution of comets. Such an example has been, to a great extent, supplied by the third comet of 1853; but, alas! the piercing intellect which might be expected most effectually to profit by it has disappeared for ever from the stage of earthly existence.

DISTANCES OF THE FIXED STARS.

DURING the year 1853, the distances of two of the fixed stars have formed the subject of much profound research. One of these is the bright star in the constellation of the Lyre, termed Vega. This star is the brightest in the Northern Hemisphere. At this season

of the year, January, it may be seen late in the evening, occupying a low position in the north-western part of the heavens, being readily distinguishable from the stars around it by its superior lustre. The parallax of this star had been determined in the year 1835, by M. F. W. Struve, an astronomer of great celebrity, who is at present Director of the Imperial Observatory of Pulkowa, in Russia. The inquiry has been renewed in the present year by his son, M. Otho Struve, who has found, by combining the researches of his father with his own, that the distance of the star from the earth is no less than 130 billions of miles! Light, travelling at the rate of 192 thousand miles in a second, consequently occupies twenty-one years in passing from the star to the earth. Now, it has been found, by comparing the light of Vega with the light of the sun, that if the latter were removed to the distance of 130 billions of miles, his apparent brightness would not amount to more than the sixteenth part of the apparent brightness of Vega. We are, therefore, warranted in concluding that the light of Vega is equal to that of sixteen suns.

When a star has a large proper motion, independently of the effect due to the motion of the solar system in space, we may reasonably infer that it is comparatively near to us, even although it may not be very bright. It is upon this principle that a star in the constellation of the Great Bear, which has an uncommonly large proper motion, has been suspected to have a sensible parallax. The recent researches of M. Peters, a German astronomer, have served to confirm this view of the subject. The result obtained by him indicates the star to be situate at a distance of 135 billions of miles.

DOUBLE STARS.

THE researches of M. Villarceau, a French geometer, on the theory of double stars, have led to some curious results. One of the most interesting of such objects is the star in the constellation of the Northern Crown, marked in the Catalogue of Stars with the seventh letter of the Greek alphabet. Two observations of this star, made by Sir William Herschel in the years 1781 and 1802, afford valuable data for determining the orbit of the companion; but from the close physical resemblance of the two constituent bodies, and the consequent difficulty of identifying the companion in these observations, the resulting elements of the orbit were to a certain extent ambiguous. In a memoir which he communicated to the French Institute on a former occasion, M. Villarceau announced that the revolution of the companion around the principal star was either forty-three years or sixty-seven years, according to the interpretation put upon the observations of Sir William Herschel: and he announced that the observations of the year 1853 would decide which of the two results was the correct one. Now, it appears, from researches prosecuted by him in the course of the past year, for the purpose of establishing this delicate point, that the period of revolution is in reality sixty-seven years. This star is remarkable among all the double stars whose orbits have hitherto been determined, for the rapid revolution of the companion around the principal star.

An opinion has been suggested in some cases respecting the

probability of an opaque body revolving round a bright one. A more startling hypothesis has been advanced by the illustrious Bessel, viz., that of *the revolution of a star around an invisible or dark body.* This bold idea was suggested to him by certain irregularities which he discovered in the proper motions of the stars Sirius and Procyon. Subsequently, attempts have been made to account for these irregularities by a supposed defect in the instruments with which the observations were made. M. Le Verrier, however, by a profound discussion of the observations of the stars, made at the Royal Observatory of Greenwich since the middle of the last century, has arrived at a conclusion which, in so far as regards Sirius, affords a complete confirmation of the view of the subject taken by Bessel. This is certainly one of the most remarkable results of modern astronomical investigation.—*Grant.*

TRANSPARENT ATMOSPHERE.

If we are to rely upon the statements of the Rev. Mr. Stoddart, an American missionary, Oroomiah, in Persia, seems to be, in so far as regards the transparency of the atmosphere, the most suitable place in the world for an astronomical observatory. Writing to Sir John Herschel from that country, he mentions that he has been enabled to distinguish with the naked eye the satellites of Jupiter, the crescent of Venus, the rings of Saturn, and the constituent members of several double stars!—*Grant.*

WHIRLWIND AND WATERSPOUT IN THE MEDITERRANEAN.

On the 16th of August, vessels sailing in the waters of Tunis were surprised by a sudden whirlwind, which threw several laden with grain on their beam-ends, and compelled them eventually to enter Tunis to righten their shifted cargoes. On the following day, a huge Waterspout passed over the town of Leghorn at nine in the morning; and breaking, accompanied by a whirlwind, unroofed houses and buildings, carried away window-frames and blinds, uprooted trees and shrubberies, and caused much damage.

THE LAWSON MIDLAND OBSERVATORY.

In the year 1852, Mr. Lawson, of Bath, to whom is due the merit of many remarkable improvements in astronomical and meteorological instruments, offered to present the whole of his valuable collection to the people of the Midland Counties, for the institution of an observatory at Nottingham; the pure atmosphere and elevated site of Sherwood Forest, and the great blank in the English observatories at that particular point, justifying its selection. Mr. Lawson's offer, in point of intrinsic value, was a munificent gift, the worth of the instruments being stated at £10,000.* Now, it was estimated that a corresponding sum of £10,000 would be required to meet the

* The real value of the instruments has been impugned by Mr. Russell Hind, who considers them to be not worth more than £2000; and Sir James South offers to buy such instruments as constitute the bulk of Mr. Lawson's collection at much lower prices than those affixed to them.

expense of the Observatory site and edifice, with the endowment for a resident astronomer. Towards this amount Mr. Lawson himself contributed £1000. A committee was speedily formed at Nottingham, who succeeded in raising upwards of £4000, and memorialised the Lords of the Treasury for a grant of £2000, which being reasonably calculated on, the attainment of the grand object appeared almost within the grasp of its promoters. Meanwhile, Mr. Lawson, experiencing the approach of age and infirmities, and unable longer to leave the offer he had made, as he expressed it, an open question, felt the necessity of limiting the time for the raising of the subscriptions to the 1st of October, 1853. Under these circumstances, the most strenuous exertions were made in the locality, as well as in scientific circles generally, to accomplish the object before the stated time. It was strongly urged that important advantages to the country at large would accrue from the establishment of this Midland Observatory, as a central point for the regulation of British time; as an additional place of inter-communication of British and foreign astronomers; and as a contribution to the means of observation and discovery; but more especially as respects the meteorological apparatus of Mr. Lawson's collection. This includes a fine refracting telescope, by Dollond, with an object-glass of 7 inches clear aperture, and a focal length of 120 inches; attached to its axis is a mercurial clock; the eye pieces are numerous and complete, and the micrometers are very good.

Among the other instruments are a transit instrument; a magneto-electric dial; and an atmospheric recorder, invented by Mr. Lawson; a standard barometer; a Danish hygrometer; electrical apparatus; quadrants, levels, &c., indispensable in an observatory.

The exertions of Mr. Lowe and the other members of the Local Committee have been crowned with success, and the Midland Counties Observatory is to be established. At a special meeting of the Town Council, held in the Guildhall at Nottingham, it was unanimously resolved that three acres of land on the Forest, or six acres on Mapperly Plain, be presented to the Committee, with the condition that, should any other site be preferred, the corporation be allowed to purchase back their land for £500. With this grant, and Mr. Lawson's donation of £1000, and the £2000 granted by the Treasury, the sum of £10,000 has been made up within nearly £1000, under which circumstances the Committee guaranteed the remainder. The subscriptions include one hundred guineas from His Royal Highness Prince Albert. The Lords of the Treasury, in responding to the application for aid, stated that they did not consider there was any public call for an additional observatory for astronomical purposes; but that for meteorological observations the institution might prove of great national benefit, and that the grant would be given on the understanding that particular attention would be paid to this department. The advice of Professor Airy and of Sir John Herschel was taken by the Treasury.

METEOROLOGY OF 1853.

Results deduced from the Meteorological Register kept at the Royal Observatory, Greenwich, during the year 1853, under the Superintendence of the Astronomer Royal.

Months.	Mean Reading of Barom.	Mean Tension of Vapour.	Mean Pressure of Dry Air.	Temperature of Air.							Temperature of				Rain.		Weight of Vapour in Cubic ft. of Air.	Mean additional Weight required to saturate a cubic foot of Air.	Mean Degree of Humidity.	Mean Weight of a cubic foot of Air.
				Dry Bulb Therm.	Self-Reg. Therm.	Adopted.	Highest.	Lowest.	Range.	Mean Daily Range.	Evap.	Evap. below Air.	Dew Point below Air.	Dew Point	No. of Days.	Amount in Inches.				
	In.	In.	In.	°	°	°	°	°	°	°	°	°	°	°		Ins.	Gr.	Gr.		Gr.
Jan ……	29·570	·231	29·339	42·4	42·4	42·4	55·5	30·8	24·7	10·1	39·8	2·6	6·2	36·2	20	2·0	2·7	0·6	·808	542
Feb ……	29·525	·167	29·358	33·0	33·6	33·3	45·0	20·5	24·5	10·1	31·0	2·3	6·2	27·1	13	0·9	2·0	0·5	·801	552
March..	29·780	·198	29·582	38·9	38·0	38·5	60·5	20·8	39·7	16·1	35·8	2·7	6·8	31·7	14	1·5	2·3	0·6	·788	550
April….	29·710	·246	29·464	45·0	45·4	45·2	62·0	32·3	29·7	14·2	42·0	3·2	7·2	38·0	16	3·1	2·8	0·8	·778	541
May……	29·754	·297	29·457	52·0	50·8	52·0	78·8	32·6	46·2	21·2	47·8	4·2	8·6	43·4	12	1·6	3·4	1·2	·746	534
June …	29·729	·346	29·383	58·5	57·8	58·2	81·0	39·9	41·1	18·7	52 6	5·6	8 6	49·6	17	2·8	3·9	1·6	·706	527
July …	29 728	·404	29·324	60·4	60·1	60 3	81·7	48·3	33·4	17 1	55·8	4·5	8·1	52·2	17	6·0	4·5	1·4	·760	524
Aug……	29·793	·406	29·387	60·3	59·6	60 0	77·5	45·8	31·7	19·1	55·8	4·2	7·5	52·5	10	2·2	4·6	1·3	·777	526
Sept …	29·833	·375	29·458	55·6	54·9	55·3	73·0	37·5	35·5	18·0	52·7	2·6	5·1	50·2	15	2·4	4·3	0·8	·845	531
Oct ……	29·558	·347	29·211	51·0	50·6	50·9	67·0	31·7	35·3	15·2	49·0	1·5	3·2	47·7	27	4·3	3·9	0·4	·901	531
Nov ……	29·941	·266	29 675	43·3	41·6	42·1	60·8	25·8	35·0	11·5	41·3	0·8	2·0	40·1	11	1·5	3·1	0·2	·934	549
Dec……	29·804	·195	29 609	33·9	34·2	34·0	50·8	18·0	32·8	9·3	33 0	1·0	2·7	31·3	12	0·7	2·3	0·2	·913	556

EXPLANATION.

The cistern of the barometer is about 159 feet above the level of the sea, and its readings are coincident with those of the Royal Society's flint-glass barometer. The observations are taken daily at 9 A.M., noon, 3 P.M., and 9. P.M.; the means of these readings are corrected for diurnal ranges by the application of Mr. Glaisher's corrections, as published in the *Philosophical Transactions*, Part I. 1848, and from the readings of the dry and wet bulb thermometers, thus corrected. The several hygrometric deductions in columns 3, 15, 18, 19, 20 and 21, are calculated by means of Mr. Glaisher's Hygrometric Tables.

The numbers in column 2 show the mean reading of the barometer every month, or the mean length of the column of mercury which balanced the whole weight of atmosphere of air and water; the numbers in column 3 show the length of a column of mercury balanced by the water mixed with the air alone; and the numbers in column 4 show the length of a column of mercury balanced by the air alone, or that reading of the barometer which would have been had no vapour been mixed with the air.

[*Concluded on next page.*

The numbers in columns 5 and 6 are determinations of the mean temperature of the air by different instruments and methods—those in column 5 by the readings of a simple thermometer, taken at the times before-mentioned, and those in column 6 by the readings of self-registering thermometers daily. The numbers in column 7 shew the mean temperature of the air in every month; those in column 12, the true temperature of evaporation, and those in column 15 the true temperature of the dew point, or that temperature at which the vapour in the air is deposited in the shape of water.

The mean reading of the barometer for the year 1853 was 29·727 inches; the mean temperature for the year was 47°·7; that of evaporation was 44°·7; and that of the dew-point was 41°·0. Rain fell on 184 days; and the amount collected was 29·0 inches.

The temperature of January exceeded the average of 80 years by 6½°; February was 5°; March was 2½°, and April and May ½° below; June was about its average; July was 1°, August ½°, and September 1° below; October was 1½° in excess; November was ½°, and December was 4¾° below their average values, according to Mr. Glaisher's determination of the mean temperature of each month.

The meteorology of the last three months of the year has been remarkable. With regard to temperature during the period from October 21 to November 8, the mean temperature was 5° *above*, and on that following November 9 was 5° *below* the average, and continued so almost continuously till the fall of snow on January 3rd of the new year. The distribution of temperature in October, November, and December, over England, is as follows:—In October, from Jersey to lat. 51°, the mean temperature declined 4° only, between 51° and 53° there was no difference; but south of lat. 51° and north of lat. 53°, the decline of temperature from October and November was about 6°. Between these parallels the decline was as great as 9°, forming a band of cold the greatest that was experienced over the country. With reference to minimum temperature during the quarter, we find this band of cold still more strongly marked. Whilst in Jersey and Guernsey the lowest temperature was 41°, it was below 30° at all places between the parallels of 51° and 54°, excepting those situated near the sea. In November, the lowest temperature in Jersey was 35°, but as low as 20° betwen 51° and 54°, and higher elsewhere. In December, the lowest temperature from Jersey to Cornwall was 25°, it was as low as 9°, 10°, and 11°, between the latitudes of 61° and 54°, and was several degrees higher north of these parallels. During the year fog has been very prevalent; it occurred on 14 days in January, 13 in February, and 18 in March, and was chiefly confined to between latitudes 51° and 53°. Below 51°, it does not appear to have extended. In April, May, and June, it was prevalent on 5, 19, and 10 days respectively. In July, August, and September, on 1, 8, and 16 days respectively, and prevailed only between parallels 51° and 52°. In the meteorology of the last three months it forms a remarkable feature, and was prevalent at one place or another, on two out of three days during the quarter. In November only two days were free—the 5th and 29th. Some of these fogs nearly enveloped the whole country at one time, and were remarkable for density. They however hung most pertinaciously over the parallels between 51° and 53° occupying the band of cold before referred to. In December they were more scattered, and were more frequent north of parallel 53° than south of it.

At the meeting of the British Meteorological Society, on January 24, Mr. Glaisher read a paper on the "Meteorology of the quarter ending December 31, and, in conclusion, called attention to the crystals of snow which fell on the morning of January 1, 1854, in evidence of the intense cold with which they had been formed: of several he produced photographic copies.

With reference to the fall of snow, the first of the season fell on Nov. 17, in the neighbourhood of Chester and at North Shields. It fell generally at places N. of 51° on the 24th. After the 15th of December, it fell at nearly every place; and on 27, 28, and 31, at Jersey and Guernsey. It fell far more frequently between lats. 51° and 53° than elsewhere. The fall of snow, on December 15, was in many places as deep as 6 inches. A very rapid diminution of temperature took place, followed by a very slow increase. In some parts the temperature descended to 12° on December 16, and at Linslade, on the 17th, the reading of the thermometer was as low as 6°. The temperature then rose somewhat; but at Christmas the cold set in again with renewed severity, and the maximum cold of the season, in the whole country, took place during the night of December 28-29.

Obituary.

LIST OF PERSONS EMINENT IN SCIENCE OR ART. 1853.

PROFESSOR C. B. ADAMS, the American conchologist.

D. ADOLPHE OVERWEG, explorer of the Interior of Africa. (Sept. 27, 1852.)

D. BEREIRD, medical science.

JAMES FRANCIS STEPHENS, entomologist.

EMILE DEVILLE and DURET, travellers.

M. ORFILA, the well-known professor of chemistry, a member of the Academy of Medicine. "His scientific reputation," says *Galignani*, "may be said to have commenced with his 'Treatise on Poisons; or, General Toxicology.' The next works published by him, which acquired European reputation, were the 'Elements of Legal Medicine' and 'Lessons on Legal Medicine,' which went through several editions;—but he was also the author of many other works of almost equal celebrity."

LIEUT. W. S. STRATFORD, R.N., editor of the *Nautical Almanack*.

M. DE JUSSIEU, President for the year of the Academy of Sciences, at Paris.

BRANSBY COOPER, F.R.S., the eminent surgeon.

THEODORE OLIVIER, French geometrician.

WILLIAM HICKEY, the popular agricultural writer as "Martin Doyle."

H. E. STRICKLAND, geologist.

ARAGO, the well-known Perpetual Secretary of the Academy of Sciences, at Paris.

AUGUSTE ST. HILAIRE, of the Section of Botany, in the Paris Academy.

ROBERT FORREST, the Scottish sculptor.

LIEUT. BELLOT, R.N., the Arctic explorer.

CAPT. WARNER, of "war projectile" repute.

G. P. HARDING, artist.

PROFESSOR W. SEWELL, writer on veterinary subjects.

M. DE BOUTON, painter, and inventor of "The Diorama."

BRAUNE, the German botanist.

SAMUEL WILLIAMS, draughtsman, and engraver on wood.

MR. TRUBSHAW, civil engineer. His greatest work is the stone bridge on the River Dee, at Chester, of 200 feet span, the largest in the world; which was undertaken by Trubshaw when Telford and other celebrated engineers pronounced it almost impracticable, and which no other man in this kingdom could at that time be found to execute.

VON BUCH, the eminent geologist. The following is a letter from Humboldt to Sir R. I. Murchison, announcing his death, (*Athenæum*, No. 1924.)—"That I should be destined—I, an old man of eighty-three—to announce to you, dear Sir Roderick, the saddest news that I could have to convey—to you for whom M. De Buch professed a friendship so tender, and to the many admirers of his genius, his vast labours, and his noble character! Leopold De Buch was taken from us this morning by typhoid fever, so violent in its attack that two days only of danger warned us. He was at my house so lately as the 26th [ult.] despite the snow and the distance between us, talking geology with the most lively interest. That evening he went into society; and on Sunday and Monday (the 27th and 28th) he complained of a feverish attack, which he believed to be caused by a large chilblain swelling from which he had suffered for years. The inflammation required the application of leeches, but the pain and the fever increased. He was speechless for forty-eight hours. * * He died surrounded by his friends,—most of whom knew nothing of his danger till Wednesday evening, the 2nd of March."

GENERAL INDEX.

86, Fleet Street, *London.*
January 1854.

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